1952

The Iowa State College Bulletin General Catalog

Iowa State University

THE IOWA STATE COLLEGE BULLETIN

General Catalog

ANNOUNCEMENTS

1937 • 1938

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GOVERNMENT OF THE IOWA STATE COLLEGE

The laws of the United States and of the State of Iowa provide for resident academic instruction, research, and extension education, and for the management of the Iowa State College of Agriculture and Mechanic Arts. The College is governed by the Iowa State Board of Education, nominated by the Governor of Iowa and confirmed by the Senate of Iowa. The immediate regulation and direction of the academic, research, and extension activities of the College are delegated by the Board of Education to the President and Faculty of the College. The Board appoints a Finance Committee whose members give their entire time to consideration of the financial activities of the five state educational institutions, under statutory provisions and such rules and regulations as the State Board of Education may prescribe.

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CAMPUS
IOWA STATE COLLEGE
AMES IOWA

GOLF COURSE

COLLEGE CEMETERY

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RADIO TOWER

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SHEEP BARN

HOG BARN

WILSON ROAD

STOCK PENS

CHEM BLDG

ATOMIC RES.

PHYSICS BLDG.

BLDG O

OSBORN DRIVE

SIXTH STREET

0 100 200 300 400 500 600 800 1000

SCALE FEET

N

OAKLAND ST

ELECTRICAL ENGINEERING

SERVICE BLDG.

BLDG R

BLDG S

BLDG T

BLDG N

LIBR

HOME ECONOMICS

PARKING AREA

FORMAL GARDENS

BOT. GREEN HOUSES

BOT. HALL

HORT. LAB

HORT. GREEN HOUSES

FARM HOUSE

KNOLL ROAD

AGRONOMY BLDG.

SOIL TEST & FOOD PROCESS

POULTRY

AGRONOMY GREENHOUSES

GREENHOUSES

CHEM ANNEX-2

CENT. STORES

WALLACE RD.

LANDSCAPE ARCHITECTURE

COLLEGIATE PRESS

POWER PLANT

BISSELL ROAD

CHEM ENGR

BLDG K

BLDG L

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MARSTON COURT

BK STORE

MORRIL HALL

DAIRY

INDUSTRY

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EXHIBIT HALL

ENGR EXPR STA

IND. ARTS

ENGR ANNEX

MARSTON HALL

RIGGS COURT

NAVAL ARMORY

BLDG B

AERONAUTICS

BLDG C

BLDG D

BLDG E

BLDG F

BLDG G

BLDG H

BEARDSHEAR HALL

ENGL BLDG.

MORRILL ROAD

CURTISS

PARKING AREA

PARKING AREA

AGR ANNEX

WOMEN'S GYM.

WOMEN'S PLAY FIELD

TENNIS COURTS

M E LAB

T & A M LAB

COTTAGES

CAMPANILE

SLOSS HOUSE

OSBORN COTTAGE

DRIVE

TENNIS COURTS

WEST ST.

UNION

PARK AREA

HOSPITAL

ALUMNI HALL

GYMNASIUM

BOWL. GREEN

MUSIC HALL

UNION DRIVE

ELM

OAK

RICHARDSON COURT

WALLACE ROAD

HYLAND AVE.

SHELDON AVE.

W STADIUM

CLYDE WILLIAMS FIELD

E STADIUM

BEYER COURT

FRILEY HALL

LAKE LA VERNE

WELCH ROAD

MORRILL ROAD

MEMORIAL UNION

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CARRIE LANE COURT

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ROBERTS

WELCH

BIRCH

L-WAY COTTAGE

RICHARDSON CT.

LINCOLN WAY

U. S. 30

TO AMES

TO DAIRY, POULTRY, HORTICULTURE, AND AGRONOMY FARMS

TO ANIMAL HUSBANDRY AND VETERINARY FARMS

HAYWARD AVE.

WELCH AVE.

STANTON AVE.

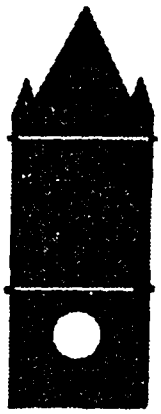
LYNN AVE.

ASH AVE.

GRAY AVE.

BEECH AVE.

JUNE, 1930



THE IOWA STATE COLLEGE BULLETIN

GENERAL CATALOG

ANNOUNCEMENTS

1952 - 1953

VOLUME L, No. 31 JANUARY 2, 1952

AMES, IOWA

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Contents

College Calendar
1952-1953

1952 FALL QUARTER

September 17, Wednesday, 1 00-5.00 P.M.	Examinations to Remove Entrance Deficiencies or to Secure Advance Standing
September 17, Wednesday, 10:00 A.M.	Opening Faculty Convocation
September 18-19, Thursday and Friday	Examinations to Remove Conditions
September 18-23, Thursday, 7:45 A.M. to Tuesday, 5:00 P.M.	Freshman Days
September 22-23, Monday and Tuesday, 8:00 A.M.-4:30 P.M.	Registration—Classification
September 24, Wednesday, 8:00 A.M.	Class Work Begins
October 15, Wednesday, 4:00-6:00 P.M.	Senior English Examination
November 1, Saturday	Mid-quarter Reports Due
November 1, Saturday	Final Date for Filing Diploma slips for Fall Quarter
November 26-December 1, Wednesday, 11:00 A.M. to Monday 8:00 A.M.	Thanksgiving Vacation
December 19, Friday, 10:00 A.M.	End of Examination Period
December 19, Friday, 10:30 A.M.	Graduation Exercises

1953 WINTER QUARTER

January 3, 1953, Saturday	Examinations to Remove Entrance Deficiencies, to Secure Advance Standing, or to Remove Conditions
January 5, 1953, Monday, 8 00 A.M.-4:30 P.M.	Registration—Classification
January 6, Tuesday, 8:00 A.M.	Class Work Begins
January 21, Wednesday, 4:00-6:00 P.M.	Senior English Examination
February 7, Saturday	Mid Quarter Reports Due
February 7, Saturday	Final Date for Filing Diploma Slips for Winter Quarter
March 21, Saturday, 10:00 A.M.	End of Examination Period
March 21, Saturday, 10:30 A.M.	Graduation Exercises

1953 SPRING QUARTER

March 24, Tuesday, 8:00 A.M.	Examinations to Remove Entrance Deficiencies, to Secure Advance Standing, or to Remove Conditions
March 25, Wednesday, 8:00 A M.-4.30 P.M.	Registration—Classification
March 26, Thursday, 8:00 A M.	Class Work Begins
April 15, Wednesday, 4:00-6.00 P M.	Senior English Examination
May 2, Saturday	Mid-Quarter Reports Due
May 2, Saturday	Final Date for Filing Diploma Slips for Spring Quarter
May 30, Saturday	Memorial Day Holiday
June 7, Sunday, 7 30 P M	Baccalaureate Sermon
June 12, Friday, 3:00 P.M	End of Examination Period
June 12, Friday, 3:00 P.M	President's Reception
June 12, Friday, 7:00 P.M	Commencement
June 13, Saturday	Alumni Day

1953 SUMMER QUARTER

FIRST TERM

June 15, Monday, 8:00 A.M.-4.30 P.M.	Registration—Classification
June 16, Tuesday, 8:00 A.M.	Class Work Begins
July 4, Saturday	Independence Day Holiday
July 22, Wednesday, 5:00 P.M.	First Term Closes

SECOND TERM

July 22, Wednesday, 8:00 A.M.-4:30 P.M.	Registration—Classification
July 23, Thursday, 8:00 A.M.	Class Work Begins
August 28, Friday, 12:00 M.	Second Term Closes

Officers of Administration

CHARLES EDWIN FRILEY, B.S., A.M., LL.D., Sc.D. . President of the College
QUINCY C. AYRES, B.S., C.E. . . . . Assistant to the President

---

RAYMOND MOLLYNEAUX HUGHES, M.S., LL.D. . . . President Emeritus

DEANS AND DIRECTORS

FLOYD ANDRE, Ph.D. . . . . Dean of the Division of Agriculture, Director of the Agricultural and Home Economics Extension Service and the Agricultural Experiment Station
J. F. DOWNIE SMITH, M.E., Sc.D. . Dean of the Division of Engineering, Director of the Engineering Experiment Station and Engineering Extension Service
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*JAMES R. SAGE, M.S. . . . Registrar, Vice-Dean of the Junior College
†ARTHUR M. GOWAN, Ph.D. . . . . Registrar and Examiner

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J. E. MARKS, M.A., C.P.A. . Assistant Business Manager in Charge of Accounts
BEN W. SCHAEFER, B.S. . . . . Superintendent, Physical Plant
L. E. SAUVAIN . . . . . Purchasing Agent
J. C. SCHILLETTER, Ph.D. . . . . Director of Residence
EDGAR P. SWANSON, M.S. . . . . Supervisor of Employment

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J. F. HALL . . . . . Treasurer
FRIEDA KANKE . . . . . Assistant to the Treasurer
VERA ANDERSON . . . . . Cashier

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*JAMES R. SAGE, M.S. . . . . Registrar
†ARTHUR M. GOWAN, Ph.D. . . . . Registrar and Examiner
WAYNE A. DEVAUL, B.S. . . . . Assistant Registrar
MARY ESTHER PETERS, B.S. . . . . Assistant Examiner
ESTHER L. RAWSON . . . . . Recorder

PERSONNEL SERVICE

MAURICE D. HELSER, M.S. . . . . Director of Personnel
MRS. VIDA SECOR BENSON, B.S. . . . . Assistant Director of Personnel
JOHN L. HOLMES, M.A. . . . . Assistant Director of Personnel

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*Deceased November 18, 1951
†Appointed December 1, 1951

STUDENT HEALTH SERVICE

JOHN GRAY GRANT, M.D. . . . . Director
LYNN DODGE, M.D. . . . . Medical Advisor for Men
GAIL MCCLURE PROFFITT, M.D. . . . . Medical Advisor for Women
SARA KALAR MERRYMAN, M.D. . . . . Medical Advisor for Women
PHOEBE T. GOGGIN, M.D. . . . . Health Education for Women
JOHN F. BACON, M.D. . . . . Radiologist
ANNE REDMAN, R.N. . . . . Supervisor of Nurses

LIBRARY STAFF

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GRANT DAVID HANSON, A.M.L.S., Assistant Director
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*RICHARD JOSEPH BECK, B.S.L.S., Exchange Librarian
CHARLES HARVEY BROWN, M.A., B.L.S., Litt.D., Bibliographer
JOHN PATRICK COUGHLIN, A.M.L.S., Head, Circulation Department
PATRICIA LUNDSTEN FRITZ, B.S., Instructor
MARJORIE RUTH FULLER, M.A., B.L.S., Classifier
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JOHN CALVIN MCNEE, A.M.L.S., Reference Librarian in Charge, Physical Sciences Reading Room
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VIVIAN ALICE PETERSON, M.A., Cataloger
EVA LANNING ROBBINS, B.S, Instructor
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INEZ SMITH TUCKER, M.A., Instructor
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ELEANOR FRANCES WARNER, M.A., B.L.S., Head, Serials Department
EVELYN WIMERSBERGER, M.S., Head, Catalog Department

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MRS. HECTOR THOMPSON, M.A. . . . . Director of the Y.W.C.A.

*On leave

The Faculty

(Including members of Research and Extension Staffs†)

CHARLES EDWIN FRILEY, President, 1936, 1932‡
B.S., Texas A.&M., 1919; A.M. Columbia, 1923; LL.D., Hardin-Simmons, 1929; LL.D., Texas A.&M., 1940; Sc.D., Cornell College, 1942

Professors and Heads of Departments

JOHN M. AIKMAN, Professor of Botany (1, 2) 1945, 1927
A.B., Nebraska Wesleyan, 1917; A.M., 1921; Ph.D., Nebraska, 1928

EDWARD SWITZER ALLEN, Professor of Mathematics (1) 1943, 1921
A.B., Harvard, 1909; A.M., 1910; Ph.D., 1914

ARTHUR LAWRENCE ANDERSON, Professor of Animal Husbandry (1, 2) 1946, 1920
B.S., Minnesota, 1916; M.S., Iowa State, 1922

ERNEST WILLARD ANDERSON, Professor of Mathematics (1, 4) 1947, 1926
B.S. (C.E.), North Dakota State, 1926; M.S., Iowa State, 1928; Ph.D., 1933

FLOYD ANDRE, Dean of Agriculture and Director of the Agricultural Experiment Station and the Agricultural and Home Economics Extension Service 1949, 1932
B.S., Iowa State, 1931; M.S., 1933; Ph.D., 1936

FLOYD JAY ARNOLD, Professor of Dairy Husbandry (3) 1947, 1927
B.S., Iowa State, 1926; M.S., 1940

LIONEL K. ARNOLD, Professor of Chemical Engineering (1, 4) 1948, 1925
A.B., Ellsworth, 1920; B.S., Iowa State, 1921; M.S., 1926, Ph D., 1930

GRACE M. AUGUSTINE, Professor of Institution Management and Head of the Department (1) 1944
B.S., Columbia, 1929; A.M., 1930; Ph.D., 1935

QUINCY CLAUDE AYRES, Assistant to the President; Professor of Agricultural Engineering (1) 1945, 1920
B.E., Mississippi, 1912; B.S., 1912; C.E., 1920.

EARL S. BAIRD, Professor of Industrial Management (5) 1944, 1924
B.S., Iowa State, 1926; M.S., 1932

ARTHUR LAWRENCE BAKKE, Professor of Botany (2) 1925, 1910
B.S., Iowa State, 1909; M.S., 1911; Ph.D., Chicago, 1917

THEODORE A. BANCROFT, Professor of Statistics and Head of the Department; Director of the Statistical Laboratory (1, 2, 6) 1950, 1941
A.B., Florida, 1927; A M., Michigan, 1934; Ph.D., Iowa State, 1943

ELERY RONALD BECKER, Professor of Zoology and Entomology (1, 6) 1935, 1925
A.B., Colorado, 1920; D.Sc., Johns Hopkins, 1923

EDWARD ANTONY BENBROOK, Professor of Veterinary Pathology and Head of the Department (1) 1919, 1918
V.M.D., Pennsylvania, 1914

PAUL CLIFFORD BENNETT, Professor of Veterinary Pathology; Supervisor Iowa Veterinary Diagnostic Laboratory, 1948, 1947
B.S., West Virginia, 1923; M.S., 1925. D V M., Ohio State, 1931

†The following numbers in parentheses are used to identify the staff members with instruction, extension service or research: (1), Instruction; (2), Agricultural Experiment Station; (3), Agricultural and Home Economics Extension Service; (4), Engineering Experiment Station; (5), Engineering Extension Service; (6), Industrial Science Research Institute; (7), Institute for Atomic Research; (8), Statistical Laboratory; (9), Veterinary Research Institute.

‡First date after the name indicates date of appointment to present position; the second date, when the first fails to do so, indicates the date of first appointment in the College.

DWIGHT W. BENSEND, Professor of Forestry (1) 1947
B.S., Minnesota, 1937; Ph.D., 1942

HOBART BERESFORD, Professor of Agricultural Engineering and Head of the Department (1, 2, 3) 1946
B.S., Iowa State, 1924; A.E., 1941

REX BERESFORD, Professor of Animal Husbandry (3) 1948, 1916
B.S.A., Iowa State, 1911

HENRY DALE BERGMAN, Dean of Veterinary Medicine and Head of the Department of Veterinary Physiology and Pharmacology; Director of the Veterinary Research Institute, 1943, 1910
D.V.M., Iowa State, 1910

HARRY EDWARD BIESTER, Associate Director of the Veterinary Research Institute (9) 1949, 1920
V.M.D., Pennsylvania, 1919

EMERSON W. BIRD, Professor of Chemistry and Dairy Industry (1, 2) 1947, 1923
B.S., Pennsylvania State, 1923; Ph.D., Iowa State, 1929

CHARLES ALLEN BLACK, Professor of Soils and Climatology (1, 2) 1949, 1937
B.S., Colorado State, 1937; M.S., Iowa State, 1938; Ph.D., 1942

HENRY MONTGOMERY BLACK, Professor of Mechanical Engineering and Head of the Department (1) 1946, 1929
B.S., Iowa State, 1929; S.M., Harvard, 1934

RALPH KENNETH BLISS, Professor of Agriculture (3) 1946, 1906
B.S.A., Iowa State, 1905

WARREN B. BOAST, Professor of Electrical Engineering (1, 4) 1948, 1934
B.S. (E.E.), Kansas, 1933; M.S., 1934; Ph.D., Iowa State, 1936

WENDELL HUGHELL BRAGONIER, Professor of Botany and Head of the Department (1, 2, 3, 6) 1950, 1939
B.A., Iowa State Teachers, 1933; M.S., Iowa State, 1941; Ph.D., 1947

IVA L. BRANDT, Professor of Textiles and Clothing (1) 1920, 1912
B.S., Iowa State, 1905; M.S., Simmons, 1925

GROVER L. BRIDGER, Professor of Chemical Engineering and Head of the Department of Chemical and Mining Engineering (1, 4, 7) 1948, 1935
B.S., Rice Institute, 1933; M.A., 1935; Ph.D., Iowa State, 1938

TOM ALBERT BRINDLEY, Professor of Entomology (1, 2) 1950
B.S., Iowa State, 1928; M. S., 1929; Ph.D., 1934

CHARLES HARVEY BROWN, Professor of Library Science and Bibliographer (1) 1946, 1922
B.A., Connecticut Wesleyan, 1897; M.A., 1899; B.L.S., New York State Library, 1923; Litt.D., Connecticut Wesleyan, 1937

FRANK EMERSON BROWN, Professor of Chemistry (1, 6) 1943, 1917
A.B., Kansas State Teachers of Emporia, 1911; B S., Chicago, 1913; Ph.D., 1918

GEORGE MONROE BROWNING, Professor of Agronomy and Associate Director of the Agricultural Experiment Station (2) 1951, 1947
B.S., Missouri, 1932; M.S., West Virginia, 1934; Ph.D., 1938

RAY JAMES BRYAN, Professor of Vocational Education and Head of the Department (1, 2) 1951, 1946
B.S., Kansas State, 1933; M.S., 1937; Ph.D., Nebraska, 1940

ROBERT EARLE BUCHANAN, Professor of Agriculture (2) 1949, 1904
B.S., Iowa State, 1904; M.S., 1906; Ph.D., Chicago, 1908

*CLAWSON YOUNG CANNON, Professor of Dairy Husbandry (1, 2) 1930
B.S., Utah State, 1913; M.S., Iowa State, 1924; Ph.D., 1927

J. FRANKLIN CARLSON, Professor of Physics (1, 6, 7) 1948, 1946
A.B., California, 1928; M.A., 1930; Ph D., 1932

*On leave.

PERCY HAMILTON CARR, Professor of Physics (1) 1940, 1930
B.S., Furman, 1925; M.S., North Carolina, 1926; Ph.D., Cornell, 1930

LOWELL L. CARVER, Professor of Vocational Education (1) 1951, 1939
B.S., Iowa State Teachers, 1930; M.S., Iowa State, 1937

WALLACE LEWIS CASSELL, Professor of Electrical Engineering (1) 1941, 1939
B.S. (E.E.), Colorado, 1922; E. E., 1928; M.S. (E.E.), Purdue, 1946

ROBERT ANDREW CAUGHEY, Professor of Civil Engineering (1) 1930, 1919
B.S. (C.E.), Pennsylvania, 1907; C.E., 1916

HESTER CHADDERDON, Professor of Home Economics Education (1, 2) 1943, 1929
B.S., Nebraska, 1924; M.A., Chicago, 1928; Ph.D., Ohio State, 1938

STEPHEN JOHNES CHAMBERLIN, Professor of Theoretical and Applied Mechanics (1) 1949, 1929
B.S., Illinois, 1928; M.S., Iowa State, 1931

HORACE BELLATTI CHENEY, Professor of Soils (3) 1948, 1937
B.S., Iowa State, 1935; Ph.D., Ohio State, 1942

GERTRUDE E. CHITTENDEN, Professor of Child Development and Head of the Department (1, 2) 1943, 1936
B.S., Nebraska, 1931; M.A., 1936; Ph.D., Iowa, 1941

LESTER EARL CLAPP, Professor of Soils (3) 1947, 1931
B.S., Iowa State, 1923

FRANCIS EUGENE CLARK, Bacteriologist, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.; Professor of Soils and Climatology (2) 1950, 1946
B.A., Colorado, 1932; B.D.E., 1933; M.A., 1933; Ph.D., 1936

MARK PERKINS CLEGHORN, Professor of Mechanical Engineering (1) 1921, 1902
B.S. (E.E.), Iowa State, 1902; M.E., 1907

EDGAR VERMONT COLLINS, Professor of Agricultural Engineering (1, 2) 1947, 1918
B.S., Iowa State, 1914

MERVIN S. COOVER, Professor of Electrical Engineering and Head of the Department (1, 4) 1939, 1935
E.E., Rensselaer Polytechnic, 1914

WINFRED FORREST COOVER, Professor of Chemistry (1) 1913, 1904
A.B., Otterbein, 1900; A.M., Ohio State, 1903; D.Sc., Otterbein, 1935

CLARENCE HARTLEY COVAULT, Professor of Veterinary Medicine (1) 1937, 1917
D.V.M., Ohio State, 1911

ROSALIE RATHBONE CRAFT, Professor of Textiles and Clothing (1) 1931
B.S., Columbia, 1918; M.A., 1928

W. A. CRAFT, Animal Husbandman in charge of Regional Swine Breeding Laboratory, Bureau of Animal Industry, U.S.D.A.; Professor of Animal Husbandry (2) 1950, 1943
B.S., Iowa State, 1922 M.S., 1923; Ph.D., Wisconsin, 1932

LADIS H. CSANYI, Professor of Civil Engineering (1, 4) 1949
C.E., Brooklyn Polytechnic, 1937; M.C.E., 1940

CHARLES CALVIN CULBERTSON, Professor of Animal Husbandry (2) 1931, 1919
B.S., Iowa State, 1918; M.S., 1925

FOREST CHARLES DANA, Professor of General Engineering (1) 1926, 1923
B.S. (C.E.), Washington, 1914; C.E., Iowa State, 1924

HAROLD W. DAVEY, Professor of Industrial Economics (1, 6) 1950, 1948
A.B., Syracuse, 1936; M.A., Harvard, 1938; Ph.D., 1939

J. BROWNLEE DAVIDSON, Professor of Agricultural Engineering (1, 2) 1946, 1905
B.S. (M.E.), Nebraska, 1904; A.E., 1914; D.Engr., 1931

LOUIS DEVRIES, Professor of Modern Languages (1) 1919, 1913
A.B., Central Wesleyan, 1907; M.S., Northwestern, 1908; Ph.D., 1918

HARVY DIEHL, Professor of Chemistry (1, 6) 1947, 1939
B.S., Michigan, 1932; Ph.D., 1936

CHARLES M. DODD, Professor of Ceramic Engineering and Head of the Department (1, 4) 1939
B.Cer.E., Ohio State, 1927; Cer.E., 1933

LESTER THOMAS EARLS, Professor of Physics (1) 1951, 1938
A.B., Wisconsin, 1927; M.S., 1929; Ph.D., Michigan, 1934

ALVIN RANDALL EDGAR, Professor of Music and Head of the Department (1) 1948, 1935
B.A., Upper Iowa, 1924; M.A., Iowa, 1935; D.Mu., Upper Iowa, 1949

LEONARD Z. EGGLETON, Professor of Poultry Husbandry (3) 1951, 1946
B S., Michigan State, 1940, M S , Iowa State, 1946

HENRY EICHLING, Professor of Agriculture and Assistant to the Director of the Agricultural and Home Economics Extension Service (3) 1946, 1911
B.S.A., Iowa State, 1911

CLARENCE RICHARD ELDER, Director of Information Service (2, 3) 1948, 1941
B.S., Iowa State, 1929

MACK ALLEN EMMERSON, Professor of Obstetrics and Head of the Department (1) 1944, 1925
D.V.M., Iowa State, 1925; M.S , 1928; D.M.V., Zürich, 1930

ERCEL SHERMAN EPPRIGHT, Professor of Foods and Nutrition and Head of the Department (1, 2) 1944
B.S., Missouri, 1923; M S., Texas, 1930, Ph D., Yale, 1936

PAUL LESTER ERRINGTON, Professor of Zoology (2) 1948, 1932
B.S., South Dakota State, 1930; Ph.D., Wisconsin, 1932

ARTHUR T. ERWIN, Professor of Horticulture (2) 1940, 1900
B.S., Arkansas, 1900; M.S., Iowa State, 1902

ALEXANDER G. EVANOFF, COL., Professor of Air Science (1) 1951
B.S., Iowa, 1938

JOHN ELLIS EVANS, Professor of Psychology (1) 1947, 1921
A.B., Indiana, 1910; M A , 1911; Ph.D., Columbia, 1916

GLADYS JUNE EVERSON, Professor of Foods and Nutrition (1, 2) 1949, 1944
B.S., Wisconsin, 1931; M S , Iowa, 1933, Ph D., Wisconsin, 1942

DANIEL CLEVELAND FABER, Professor of Electrical Engineering (5) 1951, 1914
B.S., Illinois, 1908; E.E., 1911

FLORENCE A. FALLGATTER, Professor of Home Economics Education, and Head of the Department (1, 2) 1938
B.S., Minnesota, 1917; M.A., Columbia, 1927

FRED E. FERGUSON, Bulletin Editor (2, 3) 1949, 1924
B.S., Iowa State, 1922

BRUCE JUDSON FIRKINS, Professor of Soils and Climatology (1) 1937, 1917
B.S., Iowa State, 1917; M.S., 1918

THOMAS K. FITZPATRICK, Professor of Architecture and Architectural Engineering and Head of the Department (1, 7) 1947, 1945
B.Arch., Massachusetts Institute of Technology, 1932; M.Arch., 1933

JOHN ROBERT FITZSIMMONS, Professor of Landscape Architecture and Head of the Department (1) 1950, 1924
B.S., Colorado State, 1921; M.L.A., Harvard, 1924

HARRY LEWIS FOUST, Professor of Veterinary Anatomy (1) 1927
D.V.M., Ohio State, 1914

GEORGE R. FOWLER, Professor of Veterinary Surgery and Head of the Department (1) 1932, 1928
B.S., Washington State, 1925; D.V.M., 1925

GERALD WILLIS FOX, Professor of Physics and Head of the Department (1, 6, 7) 1947, 1930
A.B., Michigan, 1923; A.M., 1924; Ph.D., 1926

RODNEY FOX, Professor of Technical Journalism (1) 1949, 1936
B.S., Iowa State, 1930; M.S., Northwestern, 1941

SIDNEY W. FOX, Professor of Chemistry (1, 2, 6) 1949, 1943
B.A., California, 1933; Ph.D., California Institute of Technology, 1940

RICHARD K. FREVERT, Professor of Agricultural Engineering (1, 2) 1949, 1937
B.S., Iowa State, 1937; M.S., 1940; Ph.D., 1948

MARTIN FREDERICK FRITZ, Professor of Psychology (1, 6), 1946, 1927
B.S., Kansas State, 1924; M.S., 1925; Ph.D., Chicago, 1931

DAVID FULCOMER, Professor of Sociology (1, 6) 1949
B.A., MacAllister College, 1932; M.A., Minnesota, 1937; Ph.D., Northwestern, 1942

ALMON HOMER FULLER, Professor of Civil Engineering (1) 1920
C.E., Lafayette, 1897; M.C.E., Cornell, 1898; M.S., Lafayette, 1900; Sc.D., 1936

ELLIS I. FULMER, Professor of Chemistry and Assistant to the Director for Atomic Research (1, 7) 1947, 1919
B.A., Nebraska Wesleyan, 1912; M.A., Nebraska, 1913; Ph.D., Toronto, 1919; D.Sc., Nebraska Wesleyan, 1944

MARJORIE STUART GARFIELD, Professor of Applied Art and Head of the Department (1) 1948
B.F.A., Syracuse, 1926. M F.A., 1937

HAROLD V. GASKILL, Dean of the Division of Science and Director of the Industrial Science Research Institute, Head of the Department of Military, Naval and Air Science, 1938, 1930
B.A., Ohio State, 1926; M.A., 1927; Ph.D., 1930

ROBERT GETTY, Professor of Veterinary Anatomy and Head of the Department (1) 1951, 1941
D.V M., Ohio, 1940, M S., Iowa State, 1945, Ph D., 1949

HENRY GIESE, Professor of Agricultural Engineering (1, 2) 1930, 1914
B.S., Iowa State, 1919; M.S., 1927; Arch.E., 1930

HERBERT JAMES GILKEY, Professor of Theoretical and Applied Mechanics and Head of the Department (1, 4) 1931
B.S. (C.E.), Oregon State, 1911; S.B. (C.E.), Massachusetts Institute of Technology, 1916; B.S. (C.E.), Harvard, 1916; M.S. (T&AM), Illinois, 1923; Sc.D., Buena Vista College, 1939

HENRY GILMAN, Professor of Chemistry (1, 6) 1923, 1919
B.S., Harvard, 1915; M.S., 1917; Ph D., 1918

JOSEPH C. GILMAN, Professor of Botany (1, 2) 1934, 1918
B.S., Wisconsin, 1912; M.S., 1914; Ph.D., Washington (St Louis), 1915

JOSEPH BERTRAM GITTLER, Professor of Sociology (1, 6) 1948, 1945
B S., Georgia, 1934; M S., 1936; Ph.D., Chicago, 1941

CHARLES ALBERT GOETZ, Professor of Chemistry and Head of the Department (1, 2, 6, 7) 1950, 1948
B.S., Illinois, 1932; M.S., 1934; Ph.D., 1938

EMERY FOX GOSS, Professor of Dairy Industry (1) 1947, 1919
B.S., Iowa State, 1915; M.S., 1916

CORNELIUS GOUWENS, Professor of Mathematics (1) 1947, 1920
B.S., Northwestern, 1910; A.M., Illinois, 1911; Ph.D., Chicago, 1924

ARTHUR M GOWAN, Registrar and Examiner, 1951, 1942
B.A., Iowa State Teachers, 1932; M A., Iowa, 1939; Ph D., Iowa State, 1947

JOHN W. GOWEN, Professor of Genetics and Head of the Department (1, 2) 1949, 1937
B.S., Maine, 1914; M.S., 1915; Ph.D., Columbia, 1917

EDGAR FISHER GRAFF, Professor of Agriculture (3) 1946, 1917
B.S.A., Iowa State, 1917; M.S., 1936

JOHN GRAY GRANT, Professor of Hygiene and Head of the Department (1); Director of Hospital, 1936, 1930
B.A., McMaster, 1919; M.D., Manitoba, 1924

GERMAINE GLADYS GUIOT, Professor of Physical Education for Women and Head of the Department (1) 1941, 1940
B.S., Michigan, 1922; M.S., 1933; Ed.D., New York, 1940

HAROLD GUNDERSON, Professor of Entomology (3) 1948, 1935
B.S., Montana State, 1934; M.S., 1935; Ph.D., Iowa State, 1939

CHARLES SUMNER GWYNNE, Professor of Geology (1) 1951, 1927
A.B., Cornell, 1907; M.S., Syracuse, 1925; Ph.D., Cornell, 1927

ERNEST STRAIGN HABER, Professor of Horticulture and Head of the Department (1, 2, 3) 1949, 1920
B.S., Ohio State, 1918; M.S., Iowa State, 1922; Ph.D., 1928

HALBERT MARION HARRIS, Professor of Zoology and Entomology and Head of the Department (1, 2, 3, 6) 1949, 1923
B.S., Mississippi State, 1923; M.S., Iowa State, 1925; Ph.D., 1928

GEORGE BERNHARDT HARTMAN, Professor of Forestry and Head of the Department (1, 2) 1948, 1935
B.S., Iowa State, 1917; M.S., 1941

EARL DOWNING HAY, Professor of Mechanical Engineering (1) 1946
B.S., Rose Polytechnic, 1910; M.S., 1915; M.E., 1921

LANOY N. HAZEL, Professor of Animal Husbandry (1, 2) 1947
B.S., Texas Technological, 1933; M.S., Texas State, 1938; Ph.D., Iowa State, 1941

EARL O. HEADY, Professor of Agricultural Economics (1, 2) 1949, 1940
B.S., Nebraska, 1939; M.S., 1940; Ph.D., Iowa State, 1945

MAURICE DAVID HELSER, Dean of the Junior College and Director of Personnel, 1931, 1915
B.S.A., Ohio State, 1914; M.S., Iowa State, 1916

*JEAN CHARLES HEMPSTEAD, Professor of General Engineering (1) 1949, 1930
B.S., Iowa State, 1926; M.A., Pennsylvania, 1930; C.E., Iowa State, 1942

GEORGE OSCAR HENDRICKSON, Professor of Zoology (1, 6) 1951, 1925
B.A., Iowa State Teachers, 1921; M.S., Iowa State, 1926; Ph.D., 1929

G. ROSS HENNINGER, Assistant Director of Engineering Extension Service (5) 1951, 1950
B.S. (E.E.), Southern California, 1922

EARL ALBON HEWITT, Professor of Veterinary Physiology and Pharmacology, 1943, 1915
A.B., Des Moines, 1914; B.S., Iowa State, 1915; D.V.M., 1918; M.S., Minnesota, 1929; Ph.D., 1931

*ARCHIE HIGDON, Professor of Theoretical and Applied Mechanics (1) 1949, 1928
B.S., South Dakota State, 1928; M.S., Iowa State, 1930; Ph.D., 1936

THOMAS AUGUST HIPPAKA, Professor of Industrial Education (1) 1939
B.S., Wisconsin, 1927; M.S., 1929; Ph.D., 1938

RALPH MALCOLM HIXON, Dean of the Graduate College; Professor of Chemistry (1, 2, 6) 1950, 1923
B.S., Iowa State, 1917; Ph.D., Wisconsin, 1921

PEARL HOGREFE, Professor of English (1) 1944, 1931
B.A., Southwestern, 1910; M.A., Kansas, 1913; Ph.D., Chicago, 1927

DIO LEWIS HOLL, Professor of Mathematics and Head of the Department (1, 6) 1934, 1925
A.B. Manchester, 1917; A.M., Ohio State, 1920; Ph.D., Chicago, 1925

*On leave

PAUL G. HOMEYER, Professor of Statistics (1, 2, 8) 1949, 1937
B.S., Texas A.&M., 1934; M.S., 1936

MAX M. HOOVER, Professor of Farm Crops (2) 1947
B.S., Kansas State, 1924; M.S., 1925; Ph.D., Cornell University, 1932

ELIZABETH ELLIS HOYT, Professor of Economics (1) 1927, 1925
A.B., Boston, 1913; A.M., Radcliffe, 1924; Ph.D., 1925

HAROLD DEMOTT HUGHES, Professor of Farm Crops (1, 2) 1947, 1910
B.S., Illinois, 1907; M.S.A., Missouri, 1908

RAYMOND M. HUGHES, President Emeritus, 1936, 1927
A.B., Miami, 1893; M.S., Ohio State, 1897; LL.D., Miami, 1927; LL.D., Coe, 1928; LL.D., Iowa State, 1936

WILLIAM V. HUKILL, Principal Agricultural Engineer, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.; Professor of Agricultural Engineering (2) 1950, 1943
B.S. (M.E.), Oregon Agricultural College, 1923

*KEITH GIBSON HUNTRESS, Professor of English (1) 1946, 1941
B.A., Wesleyan, 1935; M.A., 1936; Ph.D., Illinois, 1942

*RICHARD WELLINGTON HUSBAND, Professor of Psychology (1) 1947, 1946
A.B., Dartmouth, 1926; M.A., Stanford, 1927; Ph.D., 1929

CARROLD ARTHUR IVERSON, Professor of Dairy Industry and Head of the Department (1, 2, 3) 1949, 1916
B.S., South Dakota State, 1915; M.S., Iowa State, 1917

RAYMOND J. JESSEN, Professor of Statistics (1, 2, 6, 8) 1950, 1938
B.S., California, 1937; Ph.D., Iowa State, 1943

IVER JOHANNAS JOHNSON, Professor of Farm Crops (1, 2) 1947, 1940
B.S., Minnesota, 1928; M.S., 1929; Ph.D., 1931

MAURICE JOSEPH JOHNSON, Director of Veterinary Clinics 1951, 1932
D.V.M., Iowa State, 1932

L. MEYER JONES, Professor of Veterinary Pharmacology (1) 1947, 1935
A.B., DePauw, 1935; D.V.M., Iowa State, 1939; M.S., 1939; Ph.D., Minnesota, 1945

WALTER PAUL JONES, Professor of English (1) 1932, 1931
A.B., Wabash, 1913; Ph.D., Cornell, 1925

ALFRED PAUL KEHLENBECK, Professor of Modern Languages and Head of the Department (1) 1950, 1935
B.A., Iowa, 1927; M.A., 1928; Ph.D., Wisconsin, 1934

LEONARD F. KELLOGG, Professor of Forestry (1) 1949
B.S., California, 1924; M.F., Yale, 1927

OSCAR KEMPTHORNE, Professor of Statistics (1, 2, 8) 1951, 1947
B.A., Cambridge, 1940; M.A., 1943

FRANK KEREKES, Professor of Civil Engineering and Assistant Dean of the Division of Engineering (1) 1947, 1920
B.S., College of the City of New York, 1917; C.E., Columbia, 1920

HENRY HERBERT KILDEE, Professor of Agriculture (2, 3) 1949, 1908
B.S.A., Iowa State, 1908; M.S., 1917; D.Agr., North Dakota State, 1940

WALTER BERNARD KING, Professor of Chemistry (1) 1950, 1923
B.S., Illinois, 1923; M.S., Iowa State, 1924; Ph.D., 1930

DON KIRKHAM, Professor of Soils and Climatology and Physics (1, 2) 1949, 1946
A.B., Columbia, 1933; A.M., 1934; Ph.D., 1938

HARRY HAZELTON KNIGHT, Professor of Zoology and Entomology (1) 1934, 1924
B.S., Cornell, 1914; Ph.D., 1920

*On leave.

JULIAN KNAUSE KNIPP, Professor of Physics (1, 6, 7) 1948, 1946
B.A., Illinois, 1931; M.A., Harvard, 1932; Ph.D., 1935

WILLIAM F. LAGRANGE, Professor of Animal Husbandry (1) 1920, 1917
B.S., Iowa State, 1917; M.S., 1928

WILLIAM HENRY LANCELOT, Professor of Vocational Education (1) 1923, 1918
B.S., Iowa State, 1919; D.Ed., Miami, 1932

L. JACKSON LASLETT, Professor Physics (1, 7) 1951, 1946
B.S., California Institute of Technology, 1933; Ph.D., California, 1937

ALVHH R. LAUER, Professor of Psychology (1, 6) 1941, 1925
B.A., McPherson, 1922; M.A., Iowa, 1925; M.S., Iowa State, 1928; Ph.D., Ohio State, 1929

CHESTER DANIEL LEE, Professor of Veterinary Medicine (3) 1949, 1927
D.V.M., Iowa State, 1927; M.S., 1932

ROY EMANUEL LEMOINE, Professor of Religious Education and Head of the Department (1) 1949
B.S., Northwestern, 1935; S T.B., Seabury Western Theological Seminary, 1938

JOHN H. LILLY, Professor of Zoology and Entomology (1, 2) 1948
B.S., Wisconsin, 1931; Ph.D., 1939

LAMBERT SIGFRED LINDEROTH, JR., Professor of Mechanical Engineering (1) 1949
S.B., Massachusetts Institute of Technology, 1930; M.E., Iowa State, 1950

MARGARET I. LISTON, Professor of Home Management and Economics (1, 2) 1949
B.S., Iowa State, 1927; M.A., Missouri, 1933; Ph.D., Chicago, 1949

WALTER EARL LOOMIS, Professor of Botany (1, 2) 1943, 1927
B.S., Illinois 1921; M.S., Cornell, 1922; Ph.D., 1924

FRED W. LORCH, Professor of English and Head of the Department of English and Speech (1) 1942, 1921
B.A., Knox, 1918; M.A., Iowa, 1928; Ph.D., 1936

BELLE LOWE, Professor of Foods and Nutrition (1, 2) 1936, 1918
Ph.B., Chicago, 1917; M.S., 1934

WALTER A. LUNDEN, Professor of Sociology (1, 6) 1948, 1947
B.A., Gustavus Adolphus, 1922; A.M., Minnesota, 1929; Ph.D., Harvard, 1934

JAY LAWRENCE LUSH, Professor of Animal Husbandry (1, 2), 1930
B.S., Kansas State, 1916; M.S., 1918; Ph.D., Wisconsin, 1922

MARY STEWART LYLE, Professor of Home Economics Education (1, 2) 1943, 1930
B.S., Purdue, 1921; M.S., Iowa State, 1924; Ph.D., Ohio State, 1942

JOHN B. MCCLELLAND, Professor of Agricultural Education (1, 2) 1943, 1939
B.S., Ohio State, 1921; M.S., 1927; Ph.D., 1940

ANDREW LOGAN MCCOMB, Professor of Forestry (1, 2) 1946, 1932
B.S., Pennsylvania State, 1932; M.S., Iowa State, 1933; Ph.D., 1941

GLENN B. MCCONNELL, COL., Professor of Military Science (1) 1949
B.S., U. S. Military Academy, 1924

*MURL MCDONALD, Professor of Agriculture (3) 1951, 1910
B.S.A., Iowa State, 1911

JAMES PERCIVAL MCKEAN, Professor of General Engineering (1) 1946, 1928
B.S. (C.E.), Rice Institute, 1924; M.S., Iowa State, 1929; LL.D., Des Moines College of Law, 1942

JOSEPH VANCE MCKELVEY, Professor of Mathematics (1) 1934, 1919
A.B., Westminster College, 1902; A.B., Cornell, 1906; Ph.D., 1909

GILMOUR BYERS MACDONALD, Professor of Forestry (1) 1913, 1910
B.S.F., Nebraska, 1907; M.F., 1914; D.Agr., 1947

TOLBERT MACRAE, Professor of Music (1) 1921, 1920
Drake, 1906

*On leave.

DUNCAN MALLAM, Professor of English (1) 1946, 1939
B.S., Buffalo, 1926; M.A., 1927; Ph.D., Minnesota, 1939

*CARL MALONE, Professor of Agricultural Economics (3) 1947, 1930
B.S., Iowa State, 1923

JOHN NATHAN MARTIN, Professor of Botany (1, 2) 1933, 1911
A.B., Indiana, 1907; Ph.D., Chicago, 1913

KENNETH R. MARVIN, Professor of Technical Journalism and Head of the Department (1) 1945, 1923
B.S., Iowa State, 1923; M.S., 1938

JOHN ROY MASHEK, Professor of Government (1) 1946, 1943
A.B., Minnesota, 1925; A.M., Columbia, 1933; Ph.D., Minnesota, 1939

HENRY L. MASON, Professor of Mechanical Engineering (1, 4) 1946
B.S. (M.E.), Rutgers, 1921; M E., 1926; D.Sc., Michigan, 1934

CLARENCE HOVEY MATTERSON, Professor of History and Government and Head of the Department (1) 1945, 1939
A.B., Amherst, 1929; A.M., Harvard, 1931; Ph.D., 1936

ROBERT M. MELAMPY, Professor of Zoology and Dairy Husbandry (1, 2) 1950, 1948
B.S., Wilmington, 1930; M.S., Haverford, 1931; Ph.D., Cornell, 1935

IRVING E. MELHUS, Professor of Botany; Director of the Guatemala Tropical Research Center (1, 2) 1949, 1916
B.S., Iowa State, 1906; Ph.D., Wisconsin, 1912

LOUIS EDMOND MENZE, Professor of Physical Education for Men and Head of the Department (1) 1945, 1928
B.S., Central Missouri State Teachers, 1924

IVAL ARTHUR MERCHANT, Professor of Veterinary Hygiene and Head of the Department (1) 1943, 1925
D.V.M., Colorado State, 1924; M.S , Iowa State, 1928; Ph.D., 1933; C.P.H., Yale, 1934

VILAS JAY MORFORD, Professor of Agricultural Engineering (1, 2) 1949, 1944
B.Sc., Nebraska, 1925; M Sc., 1933

*BARTON MORGAN, Professor of Vocational Education (1, 2) 1950, 1923
B.S., State Teachers Missouri, 1919; M.S., Iowa State, 1922, Ph D., Iowa, 1934

MARTIN MORTENSEN, Professor of Dairy Industry (1, 2) 1938, 1909
B.S.A., Iowa State, 1909; LL.D., Kansas State, 1934

GLENN MURPHY, Professor of Theoretical and Applied Mechanics (1, 7) 1941, 1932
B.S. (C.E), Colorado, 1929; M.S. (C.E.), 1930, M.S. (C. E.), Illinois, 1932; Ph.D , Iowa State, 1935; C.E, Colorado, 1937

HICKMAN CHARLES MURPHY, Senior Pathologist, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.; Professor of Farm Crops and Plant Pathology (1, 2) 1950, 1926
B.S., West Virginia, 1926; M.S., Iowa State, 1927; Ph.D., 1930

CHARLES MURRAY, Dean of the Division of Veterinary Medicine, Emeritus, 1946, 1908
B.Pe., Drake, 1906; B.S., Iowa State, 1910; D.V.M., 1912

WILLIAM G. MURRAY, Professor of Economics and Head of the Department of Economics and Sociology (1, 2, 3, 6) 1944, 1925
B.A., Coe, 1924; M.A., Harvard, 1925; Ph.D., Minnesota, 1932

FRANK EUGENE NELSON, Professor of Dairy Industry (1, 2) 1943, 1934
B S., Minnesota, 1932; M.S , 1934; Ph.D , Iowa State, 1936

P. MABEL NELSON, Dean of the Division of Home Economics, 1944, 1923
B.S , California, 1915; M.A., 1916; Ph D., Yale, 1923

HARRY ESMOND NICHOLS, Professor of Horticulture (1) 1948, 1918
B.S., Iowa State, 1917; M.S., 1931

*On leave

PAULENA NICKELL, Professor of Home Management and Head of the Department; Associate Dean of the Division of Home Economics (1, 2) 1949, 1936
B.S., Minnesota, 1923; M.A., Columbia University, 1927; Ph.D., Minnesota, 1932

JOSEPH HENRY NORTH, Professor of Speech and Coordinator of Radio TV Education (1) 1951, 1936
A.B., Wisconsin, 1934; A.M., Cornell, 1936; Ph.D., 1949

EDNA O'BRYAN, Professor of Applied Art (1), 1945, 1925
Diploma, Pratt Institute, 1918; B.A., Central Missouri State Teachers, 1930

JOSEPH GEORGE O'MARA, Professor of Genetics (1, 2) 1950
B.S., Massachusetts, 1933; M.S., Harvard, 1934; Ph.D., 1936

ROBERT WILLIAM ORR, Professor of Library Science and Director of the Library (1) 1946, 1930
B.S., Iowa State, 1930; M.S., Columbia, 1939

WILLIAM ABBOTT OWENS, Professor of Psychology and Head of the Department (1, 6) 1947, 1940
B.E., Winona State Teachers, 1935; Ph.D., Minnesota, 1940

FLOYD B. PADDOCK, Professor of Entomology (1, 3) 1939, 1919
B.S., Colorado State, 1911; M.S., Ohio State, 1915

OSCAR WALLACE PARK, Professor of Entomology (1, 2) 1925, 1917
B.S., Kansas State, 1917; M.S., Iowa State, 1920; Ph.D., 1924

LAWTON MIKELL PATTEN, Professor of Architecture (1) 1951, 1946
B.F.A., Washington, 1928; B.Arch., Columbia, 1933

MATTIE PATTISON, Professor of Home Economics Education (1, 2) 1948, 1940
B.S., Washington State, 1919; M.A., Chicago, 1931; Ph.D., 1945

LOUISE JENISON PEET, Professor of Household Equipment (1) 1931, 1928
B.A., Wellesley, 1908; M.A., 1911; Ph.D., Iowa State, 1929

ROBERT PENQUITE, Professor of Poultry Husbandry (1) 1946, 1930
B.S., Oklahoma A.&M., 1922; M.S., 1928; Ph.D., Iowa State, 1936

ROBERT E. PHILLIPS, Professor of Poultry Husbandry and Head of the Department (1, 2, 3) 1949, 1938
B.S., Kansas State, 1935; M.S., 1936; Ph.D., Iowa State, 1941

*BETHEL STEWART PICKETT, Professor of Horticulture (1, 2), 1947, 1923
B.S.A., Toronto, 1904; M.S., Illinois, 1906

WILLIAM H. PIERRE, Professor of Agronomy and Head of the Department (1, 2, 3) 1949, 1938
B.S., Wisconsin, 1921; M.S., 1923; Ph.D., 1925

ARTHUR R. PORTER, Professor in Charge of Dairy Husbandry (1, 2) 1951, 1935
B.S., Iowa State, 1931; M.S., Minnesota, 1939

WILLIAM RANDOLPH RAYMOND, Professor of English (1) 1921, 1907
A.B., Grinnell, 1894

C. S. REDDY, Professor of Botany (1, 2, 3) 1950, 1927
B.S., Wisconsin, 1915; M.S., 1916; Ph.D., 1922

CHARLES HOWARD RICHARDSON, Professor of Entomology (1, 2) 1931, 1928
A.B., Stanford, 1912; M.S., Harvard, 1913; Ph.D., Columbia, 1921

FRANK F. RIECKEN, Professor of Soils and Climatology (1, 2) 1947, 1942
B.S., Saskatchewan, 1930; M.S., 1934; Ph.D., Illinois, 1941

JAMES SINCLAIR RISING, Professor of Engineering Drawing and Head of Department (1) 1951
M.E., Rensselaer Polytechnic, 1925; M.S., New York State Teachers, 1936

JOSEPH L. ROBINSON, Professor of Farm Crops (2, 3) 1946, 1920
B.S., Oklahoma A.&M., 1916; M.S., Iowa State, 1918; Ph.D., 1933

*On leave

FRANK ROBOTKA, Professor of Agricultural Economics (1, 2, 3) 1937, 1920
B.S., Wisconsin, 1915; M.S., Minnesota, 1921

BRUCE A. ROGERS, Professor of Chemistry(1, 7) 1948, 1919
B.S., Iowa State, 1916; M.S., Chicago, 1920; Ph.D., Harvard, 1933

LOUISE MARIE ROSENFELD, Professor and Assistant Director for Home Economics (3) 1950, 1932
B.S., Iowa State, 1928

EARLE DUDLEY ROSS, Professor of History (1) 1943, 1923
Ph.B., Syracuse, 1909; Ph.M., 1910; A.M., Cornell, 1912; Ph.D., 1915

RALPH RUDOLPH ROTHACKER, Professor of Landscape Architecture (1) 1951, 1922
B.S., Ohio, 1918; M.S., Iowa State, 1924

CHALMER J. ROY, Professor of Geology and Head of the Department (1, 6) 1948
B.A., Missouri, 1929; M.A., 1930; A.M., Harvard, 1933; Ph.D., 1936

ARTHUR W. RUDNICK, Professor of Dairy Industry (3) 1920, 1913
B.S., Iowa State, 1910

ROBERT E. RUNDLE, Professor of Chemistry (1, 6, 7) 1946, 1941
B.S., Nebraska, 1937; M.S., 1938; Ph.D., California Institute of Technology, 1941

BURRELL FRANKLIN RUTH, Professor of Chemical Engineering (1, 7) 1942, 1938
B.S., Michigan State, 1923; M.S., 1925; Ph.D., Minnesota, 1931

**JAMES R. SAGE, Registrar; Vice-Dean of the Junior College, 1920, 1915
B.A., Ohio State, 1912; M.S., Rose Polytechnic Institute, 1915

CARL NICHOLS SANFORD, Professor of Aeronautical Engineering and Head of the Department (1) 1946, 1945
B.S. (M.E.), Oregon State, 1928; M.S. (Aero.E.), North Carolina State, 1940

JOHN E. SASS, Professor of Botany (1, 2) 1949, 1928
B.S., Michigan, 1924; M.S., 1925; Ph.D., 1929

JULIAN CLAUDE SCHILLETTER, Professor of Horticulture and Director of Residence (1) 1945, 1922
B.S, Clemson, 1922; M.S., Iowa State, 1923; Ph.D., 1930

FRITZ SCHLENK, Professor of Bacteriology (6, 7) 1950, 1947
Ph.D., Berlin, 1934

WILLIAM J. SCHLICK, Professor of Civil Engineering (1, 4) 1949, 1914
B.C.E., Iowa State, 1909; C.E., 1914

LOUIS BERNARD SCHMIDT, Professor of History (1) 1930, 1906
Ph.B., Cornell College. 1901; A.M., 1906; Litt.D., 1934

WILLIAM H. SCHRAMPFER, Professor of Industrial Economics (1) 1945, 1929
B.A., Iowa, 1926; J.D., 1928

HENRY H. SCHWANE, LT. COL., Professor of Air Science and Tactics (1) 1950
B.S., Iowa State, 1940

LOUIS HAROLD SCHWARTE, Professor of Veterinary Research (1) 1945, 1925
B.S., Cornell University, 1918; M.S., 1920; D.V.M., Iowa State, 1928; Ph.D., 1934

EUGENE TREFETHEN SEAWARD, CAPT., Professor of Naval Science and Tactics (1) 1951
B.S., U. S. Naval Academy, 1924

FREDRICA VAN TRICE SHATTUCK, Professor of Speech (1) 1916, 1907
A.B., Wisconsin, 1905

PHINEAS STEVENS SHEARER, Professor of Animal Husbandry and Head of the Department (1, 2, 3) 1949, 1912
B.S., Iowa State, 1912; M.S., 1928

GEOFFREY SEDDON SHEPHERD, Professor of Economics (1, 2) 1943, 1927
B.S.A., Saskatchewan, 1924; M.S., Iowa State, 1925; Ph.D., Harvard, 1932

EDWIN RAYMOND SMITH, Professor of Mathematics (1) 1921
A.B., Illinois, 1905; A.M., Wisconsin, 1908; Ph.D., Munich, 1911

**Deceased November 18, 1951

J. F. DOWNIE SMITH, Dean of the Division of Engineering, Director of the Engineering Experiment Station and Engineering Extension Service, 1947
B.Sc., Glasgow, 1923; M.Sc., Georgia School of Technology, 1925; M.E., Virginia Polytechnic, 1928; S.M., Harvard, 1930; Sc D., 1933

GEORGE W. SNEDECOR, Professor of Statistics (1, 2, 8) 1947, 1913
B.S., Alabama, 1905; M.A., Michigan, 1912

MERLIN G. SPANGLER, Professor of Civil Engineering (1, 4) 1947, 1924
B.S. (C.E.), Iowa State, 1919; C.E., 1926, M.S., 1928

FRANK H. SPEDDING, Director of the Institute for Atomic Research (7); Professor of Chemistry (1) 1942, 1937
B.S. (Chem.E.), Michigan, 1925; M.S., 1926; Ph.D., California, 1929; LL.D., Drake, 1946; D.Sc., Michigan, 1949

GEORGE FREDERICK SPRAGUE, Senior Agronomist, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.; Professor of Farm Crops (2) 1950
B.Sc., Nebraska, 1924; M.S., 1926; Ph.D., Cornell, 1930

JAMES ABEL STARRAK, Professor of Vocational Education (1, 2) 1940, 1920
B.S., Iowa State, 1921; M.S., 1922; D.Ed., Boston, 1932

DEAN W. STEBBINS, Professor of Physics (1, 6) 1951, 1935
B.S., Montana State, 1935; Ph.D., Iowa State, 1938

LOWELL O. STEWART, Professor of Civil Engineering and Head of the Department (1) 1938, 1924
B.S. (C.E.), Michigan State, 1917; M.S. (C.E.), Iowa State, 1927; C.E., 1928

HERMAN J. STOEVER, Professor of Mechanical Engineering (1) 1943, 1938
B.S., Purdue, 1928; M.S., Illinois, 1930; Ph.D., 1934

LENORE MARGARET SULLIVAN, Professor of Institution Management (1) 1943, 1928
B.S., Montana State, 1927; M.S., Iowa State, 1929

LYDIA V. SWANSON, Professor of Child Development (1) 1943, 1924
B.S., Nebraska, 1923; M.S., Iowa State, 1931

PEARL PAULINE SWANSON, Professor of Foods and Nutrition; Assistant Director, Home Economics Research, Agricultural Experiment Station (1, 2) 1944, 1930
B.S., Carleton, 1916; M.S., Minnesota, 1924; Ph.D., Yale, 1930

ORLAND RUSSELL SWEENEY, Professor of Chemical Engineering (1, 4) 1947, 1920
B.S., Ohio State, 1909; M.A., 1910; Ph.D., Pennsylvania, 1916; Chem.E., Ohio State, 1935

ERHARDT P. SYLWESTER, Professor of Botany (1, 3) 1949, 1930
B.A., St. Olaf College, 1930; M.S., Iowa State, 1931; Ph.D., 1946

PAUL C. TAFF, Professor of Agriculture; Assistant Director Rural Youth Leader (3) 1950, 1908
B.S.A., Iowa State, 1913; LL.D., Loras, 1949

OSCAR E. TAUBER, Professor of Physiology (1, 2) 1946, 1930
B.S., James Millikin, 1930; M.S., Iowa State, 1932; Ph.D., 1935

HENRY PETER THIELMAN, Professor of Mathematics (1) 1947, 1942
B.A., Bluffton College, 1926; M.A., Ohio State, 1927; Ph.D., 1930

BYRON HENRY THOMAS, Professor of Chemistry (2) 1931
B.S., California, 1922; M.S., Wisconsin, 1924; Ph.D., 1929

LOUIS MILTON THOMPSON, Professor of Soils and Climatology (1); Professor in Charge of Farm Operations, Agricultural Administration, 1950, 1946
B.S., Texas A.&M., 1935; M.S., Iowa State, 1947; Ph.D., 1950

SAM H. THOMPSON, Professor of Agricultural Economics (2, 3) 1930, 1914
B.S. Minnesota, 1914; M.S., Iowa State, 1923; Ph.D., Minnesota, 1938

WILLIAM H. THOMPSON, Professor of Industrial Economics (1, 6) 1951, 1942
B.S., Pennsylvania State Teachers, 1934; M.S., Syracuse, 1939; Ph.D., Iowa State, 1948

JOHN F. TIMMONS, Professor of Agricultural Economics (1, 2) 1947
B.S., Missouri, 1937; M.A., 1938; Ph.D., Wisconsin, 1945

GERHARD TINTNER, Professor of Economics, Mathematics and Statistics (1, 2) 1946, 1937
Ph.D., Vienna, 1929

ROBERT G. TISCHER, Professor of Animal Husbandry and Horticulture (1, 2) 1951, 1947
B.S., Louisiana State, 1939, M.F., 1941, Ph.D., Massachusetts, 1944

GEORGE R. TOWN, Professor of Electrical Engineering, Associate Director Engineering Experiment Station (1, 4) 1949
E.E., Rensselaer Polytechnic, 1926, D.Engr., 1929

ARTHUR PERRY TWOGOOD, Professor of Vocational Education (5) 1944, 1937
B.A., Iowa, 1924; M.S., Iowa State, 1931

LELAND ALFRED UNDERKOFLER, Professor of Chemistry (1, 2, 6) 1949, 1928
A.B., Nebraska Wesleyan, 1928; Ph.D., Iowa State, 1934

THOMAS FRANKLIN VANCE, Professor of Child Development and Psychology (1) 1927, 1914
A.B., Coe, 1909; M.A., Iowa, 1911; Ph.D., 1913

CLAUDE HALL VAN VLACK, Professor of Agricultural Engineering (3) 1944, 1934
B.S., Iowa State, 1929; M.S., Colorado State, 1936

EDGAR F. VESTAL, Professor of Botany (1, 2) 1948
B.S., Oregon State, 1916; M.S., Wisconsin, 1923; Ph.D., Iowa State, 1932

RUSSELL M. VIFQUAIN, Professor of Agriculture; Director of Short Courses, 1947, 1920
A.B., Nebraska Wesleyan, 1915; M.S., Missouri, 1917; A.B., (Ed), Nebraska Wesleyan, 1927

EMIL CONRAD VOLZ, Professor of Horticulture (1) 1928, 1914
B.S., Michigan State, 1914; M.S.A., Cornell, 1918

RAY E. WAKELEY, Professor of Sociology (1, 2, 6) 1944, 1930
B S., Pennsylvania State, 1917; M.S., Wisconsin, 1924; Ph.D., Cornell, 1928

ALBERT LYELL WALKER, Professor of English (1) 1942, 1935
B A . Park College, 1929; M.A., Iowa, 1930; Ph.D., 1936

JOSEPH KENNETH WALKUP, Professor of General Engineering and Head of the Department (1) 1942
A.B . Ohio State, 1932; B.M.E., 1932; I.E., 1941

JAMES J. WALLACE, Professor of Agricultural Economics (1, 2, 3) 1951, 1925
B S., Iowa State, 1916

HENRY ALBERT WEBBER, Professor of Chemical Engineering (1) 1941, 1923
B.S., Colorado, 1923; M.S., Iowa State, 1925; Ph.D., 1929

JOHN WEBER, JR., Professor of Architecture and Architectural Engineering (1, 7) 1951, 1938
B.S , Iowa State, 1925, M S., 1927

WALTER HOUSLEY WELLHOUSE, Professor of Zoology (1) 1934, 1921
B.A., Kansas, 1913; M.A., 1917; Ph.D., Cornell, 1920

CHESTER HAMLIN WERKMAN, Professor of Bacteriology and Head of the Department (1, 2, 6, 7) 1950, 1921
B.S., Purdue, 1919; Ph.D., Iowa State, 1923; D.Sc., Purdue, 1944

JAMES E. WERT, Professor of Vocational Education (1, 2) 1940, 1939
A.B., Adrian College, 1915; M.A., Ohio State, 1933; Ph.D., 1934

HARLEY A. WILHELM, Associate Director of the Institute for Atomic Research; Professor of Chemistry (1, 7) 1947, 1927
A.B., Drake, 1923; Ph.D., Iowa State, 1931

JOHN ANDERSON WILKINSON, Professor of Chemistry (1, 6) 1948, 1913
B.Sc., Ohio State, 1903; Ph.D., Cornell, 1909

CARROLL PATON WILSIE, Professor of Farm Crops (1, 2) 1947, 1937
B.S., Wisconsin, 1926; Ph.D., Michigan State, 1931

ROBLEY WINFREY, Professor of Civil Engineering (1, 4) 1946, 1922
B.S. (C.E.), Iowa State, 1922; M.S., 1926; C.E., 1942

LEONARD WOLF, Professor of Architecture and Architectural Engineering (1) 1946, 1937
B.S., Iowa State, 1930; M.S., 1932

WALLACE WRIGHT, Professor of Economics (1) 1938, 1930
A.B., Dartmouth, 1919; M.A., Stanford, 1924; Ph.D., 1930

Associate Professors

ROBERT W. AHLQUIST, Associate Professor of Electrical Engineering (1) 1944, 1939
B.S. (E.E.), Missouri School of Mines, 1924; M.S. (E.E.), Pittsburgh, 1935

MAURICE WILLIAM ALMFELDT, Associate Professor of Engineering Drawing (1) 1951
B.S. (M.E.), Rhode Island State, 1932

WILLIAM CARL ALSMEYER, Associate Professor of Civil Engineering (1) 1951, 1946
B.S. (C.E.), Missouri School of Mines, 1941; M.S., Washington, 1946; Ph.D., Iowa State, 1951

MARVIN A. ANDERSON, Associate Professor of Soils (3) 1949, 1939
B.S., Iowa State, 1939; M.S., 1949

VINCENT M. ANDERSON, Associate Professor of Agriculture; District Extension Supervisor (3) 1948, 1928
B.S., Iowa State, 1924

SAMUEL ARONOFF, Associate Professor of Botany (1, 7) 1948
A.B., California (L.A.), 1936; Ph.D., California (Berkeley), 1942

IRA W. ARTHUR, Associate Professor of Agricultural Economics (1, 3) 1940, 1927
B.S., Iowa State, 1916; M.S., 1927; Ph.D., Minnesota, 1939

RICHARD E. ATKINS, Associate Professor of Farm Crops (2) 1950, 1941
B.S., Kansas State, 1941; M.S., Iowa State, 1942; Ph.D., 1948

JOHN C. AYRES, Associate Professor of Bacteriology (1, 2) 1948, 1945
B.Ed., Illinois State Normal, 1936; M.S., Illinois, 1938; Ph.D., 1942

DURWOOD L. BAKER, Associate Professor of Veterinary Medicine (1) 1951, 1947
D.V.M., Iowa State, 1943

MERLE PORTER BAKER, Associate Professor of Dairy Industry (1) 1950, 1922
B.S., Iowa State, 1921; M.S., 1923; Ph.D., 1931

CHARLES V. BANKS, Associate Professor of Chemistry (1, 7) 1949, 1941
B.Ed., Western Illinois State Teachers, 1941; M.S., Iowa State, 1944; Ph.D., 1946

GERALD L. BARGER, Meteorologist, United States Weather Bureau, United States Department of Commerce; Associate Professor of Soils and Climatology (2) 1950, 1940
A.B., Simpson, 1938; M.S., Iowa State, 1942; Ph.D., 1948

EDITH P. BARKER, Associate Professor of Home Economics (3) 1947, 1918

WILLIAM BARTHOLOMEW, Associate Professor of Soils and Climatology (1,2) 1947, 1939
B.S., Brigham Young, 1939; M.S., Iowa State, 1941; Ph.D., 1947

THEODORE FRENCH BARTLEY, Associate Professor, Veterinary Clinics (1) 1951, 1948
D.V.M., Iowa State, 1933

JOHN A. BATH, Associate Professor of Psychology (1) 1949, 1946
A.B., Nebraska State Teachers, 1932; M.A., Nebraska, 1933; Ph.D., 1942

RAYMOND BENEKE, Associate Professor of Agricultural Economics (1, 2) 1950, 1945
B.S., Iowa State, 1940; M.S., 1946; Ph.D., Minnesota, 1949

RONALD CHARLES BENTLEY, Associate Professor of Agricultural Economics (3) 1948, 1925
B.S., North Dakota State, 1923; M.S., 1924

DAVID KINCAID BRUNER, Associate Professor of English (1) 1947, 1941
A.B., Washington (St. Louis), 1933; A.M., 1934; Ph.D., Illinois, 1941

WALTER F. BUCHHOLTZ, Associate Professor of Botany (1, 2) 1945, 1931
B.S., Iowa State, 1929; M.S., 1930; Ph.D., 1935

MARIE ALVERTA BUDOLFSON, Associate Professor of Home Management (1) 1949, 1942
B.S., Iowa State, 1932; M.S., 1943

WISE BURROUGHS, Associate Professor of Animal Husbandry (1, 2) 1951
B.S., Illinois, 1934; Ph.D., 1939

KENNETH DIXON CARLANDER, Associate Professor of Zoology and Entomology (1, 6) 1948, 1946
B.A., Minnesota, 1936; M.S., 1938; Ph.D., 1943

MARY AGNES FRANCES CARLIN, Associate Professor of Foods and Nutrition (1, 2) 1949, 1945
B.S., Columbia, 1931; M.A., 1933; M.S., Cornell, 1943; Ph.D., Iowa State, 1947

GERALD FRANCIS CARNEY, LCDR, Associate Professor of Naval Science and Tactics (1) 1951

CAROLYN CASON, Associate Professor of Institution Management (1) 1946, 1940
B.S., Texas, 1934; M.A., Columbia, 1939

DAMON VON CATRON, Associate Professor of Animal Husbandry (1, 2) 1948, 1945
B.S., Purdue, 1938; M.S., Illinois, 1945; Ph.D., Iowa State, 1948

WILBER JOHN CAULFIELD, Associate Professor of Dairy Industry (1) 1949, 1944
B.S., Minnesota, 1924; M.S., Pennsylvania State, 1926

SHERRET S. CHASE, Associate Professor of Botany (1, 2) 1950, 1947
B.S., Yale, 1939; Ph.D., Cornell, 1947

HARLAN LON CHENEY, LCDR, Associate Professor of Naval Science and Tactics (1) 1951
B.A., Yankton, 1941

FRED F. CLARK, Associate Professor of Agriculture; District Extension Supervisor (3) 1928, 1916
B.S.A., Iowa State, 1916

HERBERT CLARE COOK, Associate Professor of Government (1) 1930, 1928
B.A., Iowa State Teachers, 1922; M.A., Iowa, 1925; Ph.D., 1926

NORVAL H. CURRY, Associate Professor of Agricultural Engineering (1, 2) 1949, 1944
B.S., Iowa State, 1940; M.S., 1946

MARTELLE LOREEN CUSHMAN, Associate Professor of Vocational Education (1, 2) 1946, 1945
A.B., Western Michigan College of Education, 1932; A.M., Michigan, 1937; Ph.D. Cornell, 1943

GORDON C. DANIELSON, Associate Professor of Physics (1, 7) 1948
B.A., British Columbia, 1933; M.A., 1935; Ph.D., Purdue, 1940

DONALD T. DAVIDSON, Associate Professor of Civil Engineering (1, 4) 1950, 1945
B.S. (C.E.), New Hampshire, 1940; M.S., Iowa State, 1942; Ph.D., 1948

ARTHUR WILLIAM DAVIS, Associate Professor of Theoretical and Applied Mechanics (1) 1951, 1930
B.S., Iowa State, 1929; M.S., 1931; Ph.D., 1939

LYNN DODGE, Associate Professor of Hygiene (1) 1947
M.D., Buffalo, 1922

RAY O. DONELS, Associate Professor of Physical Education for Men (1) 1941, 1938
B.S., Iowa State, 1929; M.A., Iowa, 1937

CHARLES S. DORCHESTER, Associate Professor of Farm Crops (1) 1937, 1913
B.S., Iowa State, 1913; M.S., Minnesota, 1923; Ph.D., Iowa State, 1935

EDNA DOUGLAS, Associate Professor of Consumption Economics (1) 1950, 1945
B.S., North Carolina, 1938; M.A., 1939; Ph.D., 1945

FREDERICK R. DUKE, Associate Professor of Chemistry (1, 6, 7) 1948
B.A., South Dakota, 1937; Ph.D., Illinois, 1940

ROBERT E. DUNLAP, MAJ., Associate Professor of Military Science and Tactics (1) 1949
B.S. (E.E.), Virginia Military Institute, 1942

RACHEL HARTMAN EDGAR, Associate Professor of Chemistry (1) 1928, 1924
B.A., Ohio State, 1917; B.S., 1918; M.S., 1920; Ph.D., 1925

FLORENCE ANNA EHRENKRANZ, Associate Professor of Household Equipment (1, 2) 1947, 1945
A.B., California, 1930; M.A., 1936; Ph.D., 1938

JOHN C. ELDREDGE, Associate Professor of Farm Crops (1, 2) 1939, 1921
B.S., Iowa State, 1915; M.S., 1925; Ph.D., 1933

VELMER ARTHUR FASSEL, Associate Professor of Chemistry (1, 7) 1951, 1941
B.A., Southeast Missouri State, 1941; Ph.D., Iowa State, 1947

LEONARD FEINBERG, Associate Professor of English (1) 1950, 1946
B.S., Illinois, 1937; M.A., 1938; Ph.D , 1946

MABEL C. FISHER, Associate Professor of Applied Art (1) 1925, 1923
Diploma, Pratt Institute, 1923

W. CHESTER FITCH, Associate Professor of Mechanical Engineering (1) 1950, 1939
B.S., Montana State, 1938; M.S., Iowa State, 1939; Ph.D., 1950

BARBARA ELLEN FORKER, Associate Professor of Physical Education for Women (1) 1951, 1948
B S., Michigan State Normal, 1942, M.S., Iowa State, 1950

JOSEPH F FOSTER, Associate Professor of Chemistry (1, 2) 1951, 1940
B.S., Iowa State, 1940, Ph D , 1943

DEXTER FRENCH, Associate Professor of Chemistry (1, 2) 1951, 1938
B.A., Dubuque, 1938; Ph D., Iowa State, 1942

WILLIAM GEORGE GAESSLER, Associate Professor of Chemistry (2) 1931, 1911
B.S., Ohio State, 1911; M.S., 1929

WILLIAM EDWARD GALLIGAN, Associate Professor of Civil Engineering (1) 1939, 1926
B.S., Missouri, 1925; M.S., Iowa State, 1930

FANNIE ALICE GANNON, Associate Professor of Home Management (3) 1939, 1919
B.S., Iowa State, 1921

ALFRED S. GASKELL, Associate Professor of Engineering Drawing (1) 1949, 1941
B.S., Iowa State, 1932; M.S., 1933

*ROBERT E. GASKELL, Associate Professor of Mathematics (1) 1949, 1947
A.B., Albion College, 1933; M.S., Michigan, 1934; Ph.D., 1940

*HARLAN E. GEIGER, Associate Professor of Agriculture; State Older Youth Leader (3) 1949, 1935
B.S., Iowa State, 1935; M.S., 1949

HORACE R. GONZALEZ, MAJ., Associate Professor, Air Science and Tactics (1) 1950
B.A., St. Mary's (Texas), 1940

EDNA PATZIG GOUWENS, Associate Professor of Applied Art (1) 1947
Diploma, School of Fine Arts, Fontainebleau, France, 1926

NORMAN ARTHUR GRAEBNER, Associate Professor of History (1) 1950, 1948
B.S., Milwaukee State Teachers, 1939; M.A., Oklahoma, 1940; Ph.D., Chicago, 1949

THOMAS NICHOLLS GREENE, MAJ , Associate Professor of Naval Science and Tactics (1) 1951, 1949
B.A., Michigan State, 1942

J. A GREENLEE, Associate Professor of History; Assistant to the Dean of the Division of Science; Assistant to the Director of the Industrial Science Research Institute (1, 6) 1947, 1940
B.A., Iowa, 1930; M.A., 1931; Ph.D., 1934

*On leave

**W. I. GRIFFITH, Associate Professor, Information Service (Radio) 1946, 1925
B.S., Iowa State, 1899; M.D., Iowa State Teachers, 1905

HOWARD LAVERNE HAMILTON, Associate Professor of Zoology (1, 6) 1947, 1945
B.A., Iowa, 1937; M.S., 1938; Ph.D., Johns Hopkins, 1941

GLADYS E. HAMLIN, Associate Professor of Applied Art (1) 1949
Ph.B., Chicago, 1926; M.A., Columbia, 1937

GEORGE SIMMS HAMMOND, Associate Professor of Chemistry (1, 6) 1951, 1948
B.S., Bates, 1943; M.A., Harvard, 1947; Ph.D., 1947

ROBERT S. HANSEN, Associate Professor of Chemistry (1, 7) 1951, 1948
B.S., Michigan, 1940; M.S., 1941; Ph D., 1948

A. MAURICE HANSON, Associate Professor of Landscape Architecture (1) 1945, 1934
B.S., Iowa State, 1928

GRANT DAVID HANSON, Associate Professor of Library Science and Assistant Director of the Library (1) 1950
A.B., Augustana College, 1933; B.S.L.S., Illinois, 1942; A.M.L.S., Michigan, 1945

JAMES H. HARPER, MAJ., Associate Professor of Military Science and Tactics (1) 1949
B.S., Alabama Polytechnic, 1940

GLENN R. HAWKES, Associate Professor of Child Development and Psychology (1, 2) 1951, 1950
B.S., Utah State, 1947; M S , 1948; Ph.D., Cornell, 1950

EDMUND R. HERGENRATHER, Director of the Alumni Achievement Fund, Information Service, 1949
B.S., Iowa State, 1940

GERTRUDE ANNE HERR, Associate Professor of Mathematics (1) 1924, 1913
B.S., Iowa State, 1907; M.S., 1917

JOHN B. HERRICK, Associate Professor of Veterinary Medicine (1, 3) 1951, 1948
B.S., Iowa State, 1941; D V M., 1946; M.S., 1950

LAWRENCE R. HILLYARD, Associate Professor of General Engineering; Personnel Officer, Engineering Administration, 1946, 1936
B.S., Iowa State, 1932; M.S., 1936

JOHN J. L. HINRICHSEN, Associate Professor of Mathematics (1) 1940, 1929
B.S., Iowa State, 1925; A.M., Harvard, 1927; Ph.D., 1929

ALVIN B. HOERLEIN, Associate Professor of Animal Pathology (2, 9) 1948, 1947
D.V.M., Colorado A.&M., 1940; Ph.D., Cornell University, 1945

M. S. HOFSTAD, Associate Professor of Animal Pathology (2, 9) 1948, 1946
D.V.M., Iowa State, 1940; M.S., Cornell, 1941; Ph.D., 1944

HOWARD B. HOLROYD, Associate Professor of Mechanical Engineering (1) 1947
B.S., Iowa State, 1924; Ph.D., California Institute of Technology, 1929

EVERETTE N. HONG, Associate Professor of Industrial Economics (1) 1949
B.A., Washington, 1934; Ph.D., Southern California, 1942

HERBERT B. HOWELL, Associate Professor of Agricultural Economics (3) 1947, 1934
B.S., Iowa State, 1934; M.S., 1945

RICHARD B. HULL, Associate Professor of Technical Journalism; Director of Radio, Information Service (1) 1946, 1941
B.S., Iowa State, 1938

JESSE GREENVILLE HUMMEL, Associate Professor of Mechanical Engineering (1) 1910, 1903
B.S., Iowa State, 1902; M.E , 1914

JAMES E. HUMPHREY, Associate Professor of English (1) 1951, 1948
B.S., Lafayette, 1927; M.A., Michigan, 1948

KEITH MORGAN HUSSEY, Associate Professor of Geology (1) 1949
A.B., Augustana (Ill.), 1936; M.S., Louisiana State, 1939; Ph.D., 1940

**Deceased September 28, 1951

DUANE ISELY, Associate Professor of Botany (1, 2, 3) 1949, 1944
B.A., Arkansas, 1938; M.S., 1939; Ph.D., Cornell, 1942

NORMAN LEONARD JACOBSON, Associate Professor of Dairy Husbandry (1, 2) 1949, 1947
B.S., Wisconsin, 1940; M.S., Iowa State, 1941; Ph.D., 1947

EMIL HENRY JEBE, Associate Professor of Statistics (1, 2, 8) 1949
B.S., Iowa State, 1938; M.S., 1941; Ph.D., North Carolina State, 1950

ERLING N. JENSEN, Associate Professor of Physics (1, 7) 1950, 1943
A.B., Drake, 1932; M.A., Columbia, 1933; Ph D., Iowa State, 1947

DAGMAR HILDEGARDE JOHNSON, Associate Professor of Home Economics Education (1) 1951, 1948
B.S., Minnesota, 1934; M.S., 1944; Ph D., Iowa State, 1950

ELTON L. JOHNSON, Associate Professor of Poultry Husbandry (1, 2) 1949, 1948
B.S.A., Oklahoma A.&M., 1940; M.S., Purdue, 1942; Ph.D., 1948

ALMA H. JONES, Associate Professor of Child Development (3) 1939, 1922
Master of Didactics, Iowa State Teachers College, 1908; B.S., Iowa State, 1922; M.S., Columbia, 1925

JAMES EMMETT JORDAN, JR., MAJ., Associate Professor of Air Science and Tactics (1) 1951, 1950
B.S., Virginia Military Institute, 1935

DONALD R. KALDOR, Associate Professor of Agricultural Economics (1, 2) 1948, 1939
B.S., North Dakota State, 1938; M.S., Virginia Polytechnic, 1939; Ph.D., Iowa State, 1942

ROBERT RANKIN KALTON, Associate Professor of Farm Crops (1, 2) 1950, 1941
B.S., Minnesota, 1941; M.S., Iowa State, 1945; Ph D., 1947

JOSEPH MICHELS KELLER, Associate Professor of Physics (1, 7) 1947, 1946
B.S., Harvard, 1932; Ph.D., California, 1940

SAM G. KENZY, Associate Professor of Animal Pathology (2, 9) 1948, 1938
B.S., South Dakota State, 1934; D.V.M., Iowa State, 1942; M.S., 1948

ROY MILTON KOTTMAN, Associate Professor of Animal Husbandry and Assistant Dean of the Division of Agriculture (1) 1951, 1946
B.S., Iowa State, 1941; M.S., Wisconsin, 1948

EDWARD L. KOZICKY, Associate Professor of Zoology (1) 1949, 1948
B.S., Maine, 1941; M.S., Pennsylvania State, 1942; Ph.D., 1948

WILLIAM KUNERTH, Associate Professor of Physics (1) 1916, 1907
A.B., Wisconsin, 1904; M.A., 1910; Ph.D., Chicago, 1921

FRANCIS A. KUTISH, Associate Professor of Agricultural Economics (2, 3) 1947, 1936
B.S., Iowa State, 1938; M.S., 1941

PAULUS LANGE, Associate Professor of English (1) 1932, 1920
A.B., Augustana, 1918; M.A., Illinois, 1920

HARVEY LEE LANTZ, Associate Professor of Horticulture (2) 1946, 1916
B.S., Oregon State, 1916; M.S., Iowa State, 1918

JULIUS ANSGAR LARSEN, Associate Professor of Forestry (1) 1947, 1924
B.A., Yale, 1908; M.F., 1910; Ph.D., Iowa State, 1936

SAM LEGVOLD, Associate Professor of Physics (1, 7) 1946, 1935
B.A., Luther, 1935; M.S., Iowa State, 1936; Ph.D., 1946

GERALD A. LINEWEAVER, State Boys' 4-H Club Leader (3) 1947, 1936
B.S., Iowa State, 1929; M.S., 1949

CHARLES BUELL LIPA, Associate Professor of English (1) 1949, 1940
A.B., Cornell, 1927; A.M., 1928; Ph.D., 1940

JOHN WALLACE LITHERLAND, Associate Professor of Vocational Education (1) 1947
A.B., Midland College, 1928; M.A., Nebraska, 1937; Ph.D., 1947

ROSCOE ORRIN LORENZ, Associate Professor of Architecture (1) 1951, 1945
B.A., Iowa, 1936; M.S., Iowa State, 1950

RUDOLPH JOHN LUBSEN, Associate Professor of Civil Engineering (1) 1951, 1941
B.S. (C.E.), Iowa State, 1930; M.S. (C.E.), 1932

EARL ARTHUR LUEHMAN, CDR, Associate Professor of Naval Science (1) 1950
B.S., U. S. Naval Academy, 1941

CLAIR W. MCDONALD, Associate Professor of Animal Husbandry (2, 3) 1945, 1919
B.S., Pennsylvania State, 1917; M.S., 1919

FAITH M. MADDEN, Associate Professor of Household Equipment (1) 1949, 1936
B.S., Nebraska Wesleyan, 1926; M.S., Iowa State, 1936

DEE MAIER, Associate Professor of Home Economics; District Home Economics Supervisor (3) 1948, 1943
B.S., Ohio State, 1921; M.A., Chicago, 1931

*CLAIR GEORGE MAPLE, Associate Professor of Mathematics (1) 1949
A.B., Earlham, 1939; M.A., Cincinnati, 1940; D.Sc., Carnegie Institute, 1948

DON S. MARTIN, JR., Associate Professor of Chemistry (1, 7) 1947, 1946
B.S., Purdue, 1939; Ph.D., California Institute of Technology, 1944

HOWARD R. MELDRUM, Associate Professor of Soils and Climatology (2, 3) 1948, 1921
B.S., Iowa State, 1921

JESSE W. MERRILL, Associate Professor of Agriculture; District Extension Supervisor (3) 1924, 1909
B.S.A.. Iowa State, 1909

DARREL SEYMOUR METCALF, Associate Professor of Farm Crops (1, 2) 1951, 1946
B.S., Wisconsin, 1941; M.S., Kansas State, 1942; Ph.D., Iowa State, 1950

JAMES P. MICHALOS, Associate Professor of Civil Engineering (1) 1947
B.S. (C.E.), Wisconsin, 1938; M.Engr., Yale, 1945; Ph.D., Northwestern, 1949

FRANK CLIFFORD MILLER, Associate Professor of Engineering Drawing (1) 1938, 1920
B.E. (M.E.), James Millikin, 1909; M.S. (M.E.), Iowa State, 1935

V. ALTON MOODY, Associate Professor of History (1) 1930, 1925
A.B., Meridian, 1912; M.A., Tulane, 1913; Ph.D., Michigan, 1923

NELLIE MAY NAYLOR, Associate Professor of Chemistry (1) 1928, 1909
B.A., Iowa, 1908; M.S., Iowa State, 1918; Ph.D., Columbia, 1923

ILZA LOUISE NIEMACK, Associate Professor of Music (1) 1948, 1935
Certificate, Chicago Musical College, 1919

JOHN A. NORDIN, Associate Professor of Agricultural Economics (1, 2, 6) 1948, 1941
B.A., Minnesota, 1935; M.A., 1937; Ph.D., 1941

ARNE W. NORDSKOG, Associate Professor of Poultry Husbandry (1, 2) 1945
B.S., Minnesota, 1937; M.S., 1940; Ph.D., 1943

LEE T. NUTTY, Associate Professor of Agriculture; District Extension Supervisor (3) 1929, 1917
B.S.A., Iowa State, 1917

WALLACE ELMER OGG, Associate Professor of Agricultural Economics (3) 1949, 1935
B.S., Iowa State, 1931; M.S., 1944; M.A., Chicago, 1948; Ph.D., 1949

EDWARD HENRY OHLSEN, Associate Professor of Theoretical and Applied Mechanics (1) 1946, 1936
B.S. (C.E.), Iowa State, 1926; C.E., 1936

ROBERT BORGIA ORLOVICH, Associate Professor of English (1) 1946, 1940
A.B., Illinois, 1929; A.M., 1930; Ph.D., 1941

HUGO MEDFORD OTOPALIK, Associate Professor of Physical Education for Men (1) 1931, 1920
A.B., Nebraska, 1918

R. ALLEN PACKER, Associate Professor of Veterinary Hygiene (1) 1948, 1940
B.S., Iowa State, 1940; D.V.M., 1940; M.S., 1942; Ph.D., 1947

WILLIAM R. PARKS, Associate Professor of Agricultural Economics and Government (1, 2) 1948
B.A., Berea, 1937; M.A., Kentucky, 1938; Ph.D., Wisconsin, 1948

*On leave.

ALVIN PHILIP PARSONS, Associate Extension Editor (3) 1950, 1929
B.S., Iowa State, 1926

BURTON PAULU, Visiting Project Supervisor, WOI-TV, 1951
B A., Minnesota, 1931; B.S., 1932; M.A., 1934; Ph.D., New York 1949

CHRISTIAN PETERSEN, Associate Professor of Applied Art (1) 1944, 1937

CLINTON E. PETERSON, Horticulturist, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.; Associate Professor of Horticulture (2) 1950, 1946
B.S., Utah State, 1938; M.S., Iowa State, 1941; Ph.D., 1947

JOSEPH C. PICKEN, JR., Associate Professor of Veterinary Research (1) 1951, 1939
B.S., Iowa State, 1939; Ph.D., 1947

LOUIS ERWIN PINNEY, Associate Professor of Physics (1) 1945, 1930
A.B., Missouri, 1925; A.M., 1927; Ph.D., Chicago, 1942

HERBERT JOHN PLAGGE, Associate Professor of Physics (1) 1918, 1909
B.S., Northwestern, 1906; M.A., Wisconsin, 1910

RICHARD W. POHL, Associate Professor of Botany (1, 2, 6) 1951, 1947
B.S., Marquette, 1939; Ph.D., Pennsylvania, 1947

*FANNIE POTGIETER, Associate Professor of Textiles and Clothing (1) 1944, 1931
B.A., Iowa, 1922; M.A., Washington, 1928

ELVIN L. QUAIFE, Associate Professor of Animal Husbandry (3) 1917
B.S., Iowa State, 1911

FRANK KENNETH RAMSEY, Associate Professor of Veterinary Pathology (1) 1949, 1943
B.S., Northern State Teachers, 1936; M.A., Montana, 1940; D.V.M., Iowa State, 1946

J. NEIL RAUDABAUGH, Associate Professor of Vocational Education (3) 1949, 1947
B.S., Iowa State, 1932; M.S., 1937

MARION BLANCHARD RICHARDSON, Associate Professor of General Engineering (1) 1949, 1947
B.S., Pennsylvania State, 1921; M.E., 1926

PIERRE G. ROBINSON, Associate Professor of Mathematics (1) 1930, 1922
B.S., Chicago, 1914; M.S., 1922; Ph.D., 1925

CHARLOTTE ELIZABETH RODERUCK, Associate Professor of Foods and Nutrition (1, 2) 1951, 1948
B.S., Pittsburgh, 1940; M S., Washington State, 1942; Ph.D., Iowa, 1949

ROY EVERETT ROUDEBUSH, Associate Professor of Mechanical Engineering (1) 1925, 1909
A.B., Indiana, 1903; M.E., Cornell, 1907

MABLE RUSSELL, Associate Professor of Applied Art (1) 1945, 1916
Diploma, Pratt Institute, 1915; Ph.B., Chicago, 1925; M.S., Iowa State, 1933

JOHN FREDERICK SANDFORT, Associate Professor of Mechanical Engineering (1) 1948, 1939
B.M.E., Ohio State, 1933; B.I.E., 1934; M.S., Iowa State, 1948

FRANK W. SCHALLER, Associate Professor of Soils and Climatology (2) 1949
B.S., Wisconsin, 1937; M.S., West Virginia, 1941; Ph.D., 1948

HARRY J. SCHMIDT, Associate Professor of Physical Education for Men (1) 1941, 1926
B.S., Iowa State, 1925; M.A., Iowa, 1939

JESSE M. SCHOLL, Associate Professor of Farm Crops (2) 1949
B.S., Wisconsin, 1943; M.S., 1944; Ph.D., 1947

IRA SCHROEDER, Associate Professor of Music (1) 1948, 1931
B.Mu., Bush Conservatory of Music, 1927

*On leave

JOHN WARREN SEDWICK, LT. COM., Associate Professor of Naval Science and Tactics (1) 1951, 1949
B.S., U. S. Naval Academy, 1942

ALPHEUS H. SEELEY, LT. COL., Associate Professor of Military Science and Tactics (1) 1951
D.V.M., Iowa State, 1939

GEORGE SEMENIUK, Associate Professor of Botany (1, 2) 1947, 1934
B.Sc., Alberta, 1932; M.Sc., 1934; Ph.D., Iowa State, 1938

O. SETTLES, Associate Professor of Textiles and Clothing (1) 1924, 1923
Pd.B., Central Teachers College, Missouri, 1909; B.S., Columbia, 1920

T. E. SEXAUER, Associate Professor of Vocational Education (1) 1929, 1928
B.S., Iowa State, 1909; B.S. (Ag.Ed.), 1918; M.S., 1918; M.A., Columbia, 1926; Ph.D., Cornell, 1928

PAUL FREDERICK SHARP, Associate Professor of History (1) 1949, 1947
B.A., Phillips, 1939; Ph.D., Minnesota, 1947

ROBERT H. SHAW, Associate Professor of Soils and Climatology (1, 2) 1949, 1941
B.S., Iowa State, 1941; M.S., 1942; Ph.D., 1949

ELIZABETH TAYLOR SHEERER, Associate Professor of Home Economics Education and Assistant to the Dean of Home Economics (1) 1951, 1946
B.S., Seton Hill, 1938; M.S., Cornell, 1944; Ph.D., Chicago, 1949

CLIFFORD M. SIMON, Production Manager, Publication Office (2, 3) 1951, 1937
B.S., Iowa State, 1932

R. L. SINSHEIMER, Associate Professor of Physics (1, 6) 1949
S.B., Massachusetts Institute of Technology, 1941; S.M., 1942; Ph.D., 1948

ALLAN PETER SKOOG, Associate Professor of Hygiene (7) 1949
B.S., New Hampshire, 1931; M.D., Tufts Medical School, 1937

CARL R. SMITH, Associate Professor of Agriculture; District Extension Supervisor (3) 1946, 1931
B.S., Iowa State, 1931

FREDERICK G. SMITH, Associate Professor of Botany (1, 2) 1948
B.S., Chicago, 1939; M.S., Wisconsin, 1941; Ph.D., 1943

JAMES E. SMITH, CAPT., Associate Professor of Military Science and Tactics (1) 1950
B.S., Illinois, 1941

MAURICE WILLIAM SOULTS, Associate Professor of Agriculture; Associate Director of the Agricultural and Home Economics Extension Service 1951, 1933
B.S., Iowa State, 1930

WILLIAM H. STACY, Associate Professor of Rural Sociology (3) 1922, 1917
B.S.A., Iowa State, 1917; M.S., Cornell, 1922; Ph.D., Columbia, 1935

GEORGE STANFORD, Associate Professor of Soils and Climatology (2) 1950, 1940
B.S., South Dakota State, 1938; M.S., Iowa State, 1940; Ph.D., 1947

ARWARD STARBUCK, Associate Professor of English (1) 1924, 1913
A.B., Arkansas, 1908; A.M., Chicago, 1922

MARIE STEPHENS, Associate Professor of Textiles and Clothing (1) 1926, 1920
B.S., Iowa State, 1911

HAROLD STILES, Associate Professor of Physics (1) 1915, 1914
Ph B., Kenyon, 1896; A.M., Harvard, 1904; Ph.D., Northwestern, 1909

NORMAN V. STRAND, Associate Professor of Statistics (1, 6, 8) 1950, 1935
B.S., South Dakota State, 1934; M.S., 1935

EMMETT RICHARD STUBER, Associate Professor of Physical Education for Men (1) 1947
B.S., Missouri, 1927

EDITH M. SUNDERLIN, Associate Professor of Child Development (1) 1944, 1934
B.S., Iowa State, 1924; M.A., Iowa, 1931

CLAYTON SUTHERLAND, Associate Professor of Physical Education for Men (1) 1947, 1941
B.A., Coe, 1923

PEI CHING TANG, Visiting Associate Professor of Statistics (1, 8) 1951
B.Sc., National Central, Nanking, China, 1927; Ph.D., London, 1937

BERYL S. TAYLOR, Associate Professor of Physical Education for Men (1) 1950, 1937
B.S., Illinois, 1932; M.S., 1933

LEO ALMOR THOMAS, Associate Professor of Geology (1, 6) 1951, 1948
A.B., Iowa, 1940; A.M., Missouri, 1942; Ph.D., 1948

LEROY CLINTON TIMM, Associate Professor of Physical Education for Men (1) 1949, 1934
B.S., Minnesota, 1931; M.A., New York, 1933

*WILLIAM ROBERT UNDERHILL, Associate Professor of Speech (1) 1951, 1947
A.B., Manchester, 1946; M.A., Northwestern, 1947

BERNARD VINOGRADE, Associate Professor of Mathematics (1) 1948, 1945
B.S., City College of New York, 1937; M.A., Michigan, 1940; Ph.D., 1942

ADOLF F. VOIGT, Associate Professor of Chemistry (1, 7) 1947, 1942
B.A. Pomona, 1935; M.A., Claremont, 1936; Ph.D., Michigan, 1942

CLAIR BENJAMIN WATSON, Associate Professor of Architecture (1) 1951, 1946
B.F.A., Nebraska, 1935; M.F.A., Colorado, 1946

ALICE HELEN WAUGH, Associate Professor of Applied Art (1) 1948, 1927
B.S., Missouri, 1916

CHARLES ROBERT WEBER, Associate Professor of Farm Crops (2) 1949, 1942
B.S., Illinois, 1940; M.S., 1941; Ph.D., Iowa State, 1948

ESTHER WHETSTONE, Associate Professor of Home Economics; State Girls' 4-H Club Leader (3) 1947, 1943
B.S., Iowa State, 1932; M.S., 1945

WILLIAM RUSSELL WHITFIELD, Associate Professor of Poultry Husbandry (3) 1947, 1927
B.Sc., Nebraska, 1927

DALE ROWLAND WILLIAMS, Assistant Extension Editor (3) 1951, 1943
B.S., Iowa State, 1939

J. C. GILLESPIE WILSON, CDR, Associate Professor of Naval Science (1) 1950
B.S., U. S. Naval Academy, 1935

D. J. ZAFFARANO, Associate Professor of Physics (1, 7) 1949
B.S., Case Institute of Technology, 1939; M.S., Indiana, 1948; Ph.D., 1949

Assistant Professors

HARRIET ADAMS, Assistant Professor of Applied Art (1) 1944
B. of Design, Kansas, 1930; M.A., Western Reserve, 1934

HENRY H. ALBERS, Assistant Professor of Industrial Economics (1) 1949
B.A., Iowa, 1941; M.A., 1946; Ph.D., Yale, 1951

JESSE B. ALLEN, Assistant Professor of Industrial Economics (1) 1949
A.B., Berea, 1941; M.S., Indiana, 1942

ROBERT SCOTT ALLEN, Assistant Professor of Chemistry and Dairy Husbandry (2) 1949, 1940
B.S., Brigham Young, 1939; M.S., 1940; Ph.D., Iowa State, 1949

KARLYNE ALICE ANSPACH, Assistant Professor of Textiles and Clothing (1) 1948, 1941
B.S., Iowa State, 1936; M.A., Columbia, 1941

RAY E. ARMSTRONG, Assistant Professor of Agricultural Engineering (2) 1948, 1947
B.S., Iowa State, 1947; M.S., 1951

*On leave

GORDON CLEMENCE ASHTON, Assistant Professor of Animal Husbandry (2) 1951
B.S.A., Toronto, 1935; M.Sc., McGill, 1939

JOHN FREMONT BACON, Assistant Professor of Student Health Service (1) 1949
B.A., North Dakota, 1935; M.D., Pennsylvania, 1942; M.S., Minnesota, 1947

DWIGHT MURDOCH BANNISTER, Assistant Professor of Technical Journalism (1) 1951
B.S., Northwestern, 1928

LOUIS N. BASS, Assistant Professor of Botany (2, 3) 1949, 1945
B.S., Upper Iowa, 1940; M.S., Iowa, 1943; Ph.D., Iowa State, 1949

GEORGE M. BEAL, Assistant Professor of Sociology (1, 2) 1950, 1947
B.S., Iowa State, 1943; M.S., 1947

BURL V. BERRY, Assistant Professor of Physical Education for Men (1) 1950
B.S., Iowa State Teachers, 1932; M.S., Iowa State, 1946

GERHARD H. BEYER, Assistant Professor of Chemical Engineering (1, 7) 1949
B.S., Wisconsin, 1944; M.S., 1947, Ph.D., 1949

*ERWIN CLARENCE BLECKLEY, Assistant Professor of Modern Languages (1) 1948
B.A., Oklahoma, 1941; M.A., 1947; Diploma, Paris, 1948

HENRY D. BLOCK, Assistant Professor of Mathematics (1) 1949, 1946
B.S., College of City of New York, 1940; B.C.E., 1943; M.S., Iowa State, 1947; Ph.D., 1949

LEONARD J. BODENSTEINER, Assistant Professor of Agricultural Economics (3) 1947, 1937
B.S., Iowa State, 1936

GEORGE EMMANUEL BOEHNKE, Assistant Professor of Agriculture; Assistant State Boys' 4-H Club Leader (3) 1949, 1944
B.S., Iowa State, 1943

JOE MERL BOHLEN, Assistant Professor of Rural Sociology (1, 2) 1951, 1947
B.S., Iowa State, 1947; M.S., 1948

PHILIP FREDERIC BONHAG, Assistant Professor of Zoology and Entomology (1) 1951
B.S., Long Island, 1944; M.S., Pennsylvania State, 1946; Ph.D., Cornell, 1948

WILLIAM FILSON BOORE, MAJ., Assistant Professor of Air Science and Tactics (1) 1951
M.S., Colorado School of Mines, 1950

FRANK EDWARD BORTLE, Assistant Professor of Mathematics; Assistant to the Dean of the Division of Science (1) 1947, 1942
B.S., Texas A.&M., 1931; M.S., 1932; Ph.D., Iowa State, 1949

MADGE H. BOWERS, Assistant Professor of Physical Education for Women (1) 1951, 1924
B.S., Battle Creek, Michigan, 1927

FRED A. BRANDNER, Assistant Professor of Mathematics (1) 1943, 1922
B.S., Kansas State Teachers, 1921; M.S., Chicago, 1923

FRANK E. BRANDT, Assistant Professor of Speech (1) 1949, 1946
B.A., Iowa State Teachers, 1938; M.S., Iowa State, 1948

ROBERT WILLIAM BRECKENRIDGE, Assistant Professor of Mechanical Engineering (1) 1941, 1929
B.S., Iowa State, 1932; M.S., 1934; B.S. (M.E.), 1938

LILLIAN ELIZABETH BREHM, Assistant Professor of Textiles and Clothing (1) 1949
B.S., Nebraska, 1925; M.A., 1939

JOHN C. BRENNAN, CAPT., Assistant Professor of Military Science and Tactics (1) 1950
B.S.C., Notre Dame, 1941

DONALD W. BROWN, Assistant Professor of Industrial Economics (1) 1951
B.S., Kansas State, 1942; M.B.A., Denver, 1946

*On leave

JUNE C. BROWN, Assistant Professor of Applied Arts (3) 1951, 1949
B.S., Michigan State, 1924

IRENE HAYNES BUCHANAN, Assistant Professor of Textiles and Clothing (1) 1943, 1937
B.S., Iowa State, 1923; M.S., 1938

CLARENCE EVERETT BUNDY, Assistant Professor of Vocational Education (1) 1947, 1938
B.S., Iowa State, 1929; M.S., 1934

ARTHUR E. BURTON, Assistant Professor of Architecture and Architectural Engineering (1) 1949, 1946
B.S., Iowa State, 1942; M.S., 1947

LEE WRIGHT BUTLER, Assistant Professor of Physics (1) 1921, 1919
A.B., Simpson, 1914

RICHARD B. CAMPBELL, Assistant Professor of Forestry (3) 1945
B.S., Iowa State, 1935

OSCAR NORMAN CARLSON, Assistant Professor of Chemistry (1, 7) 1950, 1943
B.A., Yankton College, 1943; Ph.D., Iowa State, 1950

RICHARD J. CECH, Assistant Editor (Radio) (3) 1950, 1949
B.S., Kansas State, 1941

M. EVELYN CHAPIN, Assistant Professor of Home Economics Education (1) 1950, 1947
B.S., Iowa State, 1943; M.S., 1949

DON CLAUDE CHARLES, Assistant Professor of Psychology (1) 1951
B.A., Iowa State Teachers, 1941; M.A., Nebraska, 1947; Ph.D., 1951

PREMO CHIOTTI, Assistant Professor of Chemistry (1, 7) 1950, 1945
B.S., Illinois, 1938; Ph.D., Iowa State, 1950

WALTER HARRIS CHIVERS, Assistant Professor of Veterinary Surgery (1) 1939, 1928
D.V.M., Iowa State, 1928

JOHN R. COLLIER, Assistant Professor of Veterinary Hygiene (1) 1948
D.V.M., Ohio State, 1941; M.S., Iowa State, 1951

THOMAS L. COOK, Assistant Professor of Industrial Economics (1) 1936, 1926
B.S., Iowa State, 1926; M.S., 1927

HERBERT PRESTON CORMACK, Assistant Professor of Physical Education for Men (1) 1947
B.S., Kansas State Teachers, 1928; M.A., Iowa, 1940

ARTHUR E. COTT, Assistant Professor of Horticulture (3) 1951, 1947
B.S., Missouri, 1943; M.S., 1951

OWEN JAY COTTERILL, Assistant Professor of Poultry Husbandry (1, 2) 1951
B.S., Ohio State, 1947; M.S., 1948

JOHN PATRICK COUGHLIN, Assistant Professor of Library Science; Head of Circulation Department (1) 1950
A.B., Villa Maria, 1943; B.S.L.S., Western Reserve, 1947; A.M.L.S., Michigan, 1950

JAMES MONROE CRALL, Assistant Professor of Botany (2) 1948
B.S., Purdue, 1939; A.M., Missouri, 1941; Ph.D., 1948

ADRIAN H. DAANE, Assistant Professor of Chemistry (1, 7) 1951, 1941
B.S., Florida, 1941; M.S., Iowa State, 1950; Ph.D., 1950

MARIAN ELIZABETH DANIELLS, Assistant Professor of Mathematics (1) 1919, 1914
A.B., Kalamazoo, 1903; A.B., Chicago, 1908; M.S., Iowa State, 1919

STANLEY V. DAVIDSON, Assistant State Boys' 4-H Club Leader (3) 1949, 1942
B.S., Iowa State, 1942

ALICE DAVIS, Assistant Professor of Applied Art (1) 1951
B.F.A., Iowa, 1926; M.F.A., 1932

*CHARLES THOMAS DEAN, Assistant Professor of Vocational Education (1) 1949, 1947
A.B., Peru State Teachers, 1942; M.S., Iowa State, 1948; Ph.D., 1951

DARRELL DWIGHT DEANE, Assistant Professor of Dairy Industry (1, 2) 1951
B.S., Idaho, 1938; M.Sc., Nebraska, 1939; Ph.D., Pennsylvania State, 1942

SHERWOOD SEARLE DEFOREST, Assistant Professor of Agricultural Engineering (3) 1950, 1946
B.S., Iowa State, 1943; M.S., 1947

ERVIN LOREN DENISEN, Assistant Professor of Horticulture (1, 2) 1949, 1946
B.S., Minnesota, 1941; M.S., Iowa State, 1947; Ph.D., 1949

HARRIS E. DICKEY, Assistant Professor of Mathematics (1) 1949, 1946
B.A., Cornell College, 1922; M.S., Iowa State, 1929

RUSSELL EDWARD DICKINSON, Assistant Professor of Physical Education for Men (1) 1943
B.A., Iowa State Teachers, 1922; M.A., Iowa, 1938

JAMES M. DILL, CAPT., Assistant Professor of Military Science and Tactics (1) 1951
B.S., Yale, 1940

NEIL DISQUE, Associate Director of Information Service, 1951, 1947
B.A., Dartmouth, 1932; B.J., Missouri, 1933

JOHN D. DODD, Assistant Professor of Botany (1) 1949
B.S., New York State College of Forestry, 1938; M.S., Vermont, 1940; Ph.D., Columbia, 1947

ALBERT F. DODGE, Assistant Professor of Farm Crops (2) 1949, 1948
B.S., Iowa State, 1931

BEATRICE DONALDSON, Assistant Professor of Institution Management (1) 1945, 1942
B.S., Nebraska, 1933; M.A., Columbia, 1942

ROBERT L. DOTY, Assistant Professor of Electrical Engineering (1) 1951, 1948
B.S. (E.E), Iowa, 1948

HARLAND N. DOUGHTY, Assistant Professor of Economics and Sociology (1) 1951, 1948
B.S.A., Arkansas, 1939; M.S., 1943

LLOYD DUMENIL, Assistant Professor of Soils and Climatology (2) 1950, 1946
B.S., Iowa State, 1942; M.S., 1951

EDWARD SAMUEL DYAS, Assistant Professor of Farm Crops (3) 1923, 1916
B.S., Iowa State, 1920

TETSUO EGUCHI, (7) 1951
M.S., Kyushu, Fukuoka, Japan, 1949

DOUGLAS S. ELLIS, Assistant Professor of Psychology (1) 1950
B.S., California Institute of Technology, 1946; M.A., Occidental, 1948; Ph.D., Northwestern, 1950

ALFRED J. ENGLEHORN, Assistant Professor of Soils and Climatology (2) 1930, 1925
B.S., South Dakota State, 1923; M.S., Iowa State, 1925

WALTER H. EVANS, Assistant Professor of Electrical Engineering (1) 1948, 1947
B.S. (E.E.), Oklahoma, 1946; M. (E.E.), 1947; Ph.D., Iowa State, 1951

LEROY EVERETT EVERSON, Assistant Professor of Botany (1, 3) 1948
B.S., Minnesota, 1939; M.S., 1948; Ph.D., 1950

MAX VERNON EXNER, Assistant Professor of Music (3) 1949, 1947
A.B., Columbia, 1933; M.A., 1947

JULIA M. FALTINSON, Assistant State Girls' 4-H Club Leader (3) 1949, 1941
B.S., Iowa State, 1941; M.S., Washington, 1947

ROBERT CECIL FELLINGER, Assistant Professor of Mechanical Engineering (1) 1949, 1947
B.S., Iowa, 1947; M.S., Iowa State, 1948

*On leave

EUGENE SHALLCROSS FERGUSON, Assistant Professor of Mechanical Engineering (1) 1949, 1946
B.S., Carnegie Institute, 1937

ROBERT CHARLES FINCHAM, Assistant Professor of Dairy Husbandry (3) 1948, 1941
B.S., Iowa State, 1941

RICHARD O. FISCHER, MAJ., Assistant Professor of Air Science and Tactics (1) 1951
B.S., Nebraska, 1937

JOHN CODMAN FISKE, Assistant Professor of Modern Languages (1) 1951
A.B., Harvard, 1930; A.M., Columbia, 1940

JAMES WALTER FITTS, Assistant Professor of Soils and Climatology (2, 3) 1948
B.S., Nebraska State Teachers, 1935, M S . Nebraska, 1937

ELMER S. FITZSIMMONS, Assistant Professor of Ceramic Engineering (1, 7) 1951
B.S., New York State, 1943; D.Sc., Massachusetts Institute of Technology, 1950

ERIC BEAUMONT FOWLER, Assistant Professor of Bacteriology (1, 6) 1951, 1944
B.S., Kansas State, 1942; M.S., 1944; Ph.D., Iowa State, 1950

JOHN RONALD FRAZER, Assistant Professor of General Engineering and Agricultural Economics (1, 2) 1949, 1946
B.M.E., Thomas S. Clarkson Memorial College, 1945; M.S., Iowa State, 1950

*RALPH L. FREEMAN, Assistant Professor of Mechanical Engineering (1) 1947
B.S., Michigan, 1939; M.S., Iowa State, 1950

JAMES S. FRITZ, Assistant Professor of Chemistry (1, 7) 1951
B.S., James Millikin, 1946; M.S., Illinois, 1946; Ph.D., 1948

GEORGE HENRY FROST, Assistant Professor of General Engineering (1) 1948
B.S.E., Michigan, 1939

CHARLES OLIN FRUSH, Assistant Professor of Mining Engineering (1, 4) 1948, 1946
B.S., Iowa State, 1941

ELIZABETH GENEVIEVE FULLER, Assistant Professor of English (1) 1931, 1916
A.B., Illinois, 1915; A.M., Michigan, 1922

RUSSELL E. GETTY, Assistant Professor of Forestry (1, 2) 1948
B.S., Iowa State, 1936

PHOEBE THERESA GOGGIN, Assistant Professor of Hygiene (1) 1946
M.D., School of Medicine, Royal College, Edinburgh, Scotland, 1939

MARVIN EARL GOULD, Assistant Professor of Mechanical Engineering (5) 1944, 1943
B.S., Iowa State, 1937

JEWEL GRAHAM, Assistant Professor of Foods and Nutrition (3) 1945
B.S., Oklahoma A.&M., 1925; M.S., Iowa State, 1932

MAURICE GRIFFEL, Assistant Professor of Chemistry (1, 7) 1950, 1949
B.S., City of New York, 1939; M.S., Michigan, 1940; Ph.D., Chicago, 1949

J. BRUCE GRIFFING, Assistant Professor of Genetics (1, 2) 1948, 1946
B.S., Iowa State, 1941; M.S . 1947; Ph.D . 1948

RAYMOND A. GULLEY, CAPT., Assistant Professor of Military Science and Tactics (1) 1950
B.S., Kansas State, 1948

DEAN GLAZIER HALL, CAPT., Assistant Professor of Air Science and Tactics (1) 1949
B.S., Utah State, 1942

ROBERT C. HALL, MAJ., Assistant Professor of Air Science and Tactics (1) 1951
B.S., Texas A & M, 1940

*HARRY E. HEATH, Assistant Professor of Technical Journalism (1) 1948
B.A., Tulsa, 1941; M.S.J., Northwestern, 1947

FRANCES M. HETTLER, Assistant Professor of Foods and Nutrition (1) 1945, 1937
B.S., Iowa State, 1932; M.S., 1940

*On leave

ELLIS A. HICKS, Assistant Professor of Zoology and Entomology (1) 1948, 1938
B.S., Iowa State, 1938; M.S., 1940; Ph.D., 1947

JOHN EUGENE HILLIGOSS, Assistant Professor of Music (1) 1947, 1941
B.Mu., Colorado, 1939; M.Mu., 1942; B.Mu.Ed. 1942; Ph.D., Iowa, 1951

HOWARD HARRY HINES, Assistant Professor of Economics and Sociology (1, 6) 1950
B.A., Iowa, 1942; A.M., Harvard, 1948; Ph.D., 1950

TEDDY O. HODGES, Assistant Professor of Agricultural Engineering (1, 2) 1951, 1950
B.S., Texas A & M, 1950; M.S., Iowa State, 1951

*HELEN LUCILE HOLADAY, District Home Economics Supervisor (3) 1948, 1941
B.S., Iowa State, 1940

WILLIAM L. HOLCOMB, MAJ., Assistant Professor of Military Science and Tactics (1) 1950
B.S. (E.E.), Purdue, 1941

NORMA R. HOLLEN, Assistant Professor of Textiles and Clothing (1) 1946, 1942
B.A., Iowa, 1934; M.S., Iowa State, 1943

GLENN H. HOLMES, Assistant Professor of Vocational Education (3) 1950
B.A., Iowa, 1929; M.A., 1933

JOHN LOUIS HOLMES, Assistant Professor of Psychology; Assistant Director of Personnel and Director of Testing Bureau, 1946, 1939
B.S., Ohio State, 1935; M.A., 1938

WILLIAM J. HOOKER, Assistant Professor of Botany (1, 2) 1945, 1944
B.E., Northern Illinois State Teachers, 1937; M.S., Purdue, 1939; Ph.D., Wisconsin, 1942

WILFRED TOMAN HOSMER, Assistant Professor of Civil Engineering (1) 1946
B.S. (C.E.), Iowa State, 1930; M.S., 1950

HENRY FRANCIS HRUBECKY, Assistant Professor of Mechanical Engineering (1) 1949
B.S., Illinois, 1944; M.S., 1948

DONALD E. HUDSON, Assistant Professor of Physics (1, 7) 1951
B.Phys., Minnesota, 1942; Ph.D., Cornell, 1950

JOHN HUG, Assistant Professor of Mechanical Engineering (1) 1947, 1909
B.M.E., Iowa State, 1909; M.E., 1934

DALE OTIS HULL, Assistant Professor of Agricultural Engineering (3) 1945, 1939
B.S., Iowa State, 1939; M.S., 1940

CORNIE LEONARD HULSBOS, Assistant Professor of Civil Engineering (1) 1949, 1946
B.S. (C.E.), Iowa State, 1941; M.S. (C.E.), 1949

DELLA CANDACE HURLEY, Assistant Extension Editor (3) 1947, 1946
B.S., Wisconsin, 1934

STANLEY L. ISAACSON, Assistant Professor of Statistics (1, 8) 1950
A.B., Johns Hopkins, 1945; A.M., 1947; Ph.D., Columbia, 1950

ALPHEUS MILES JENNINGS, MAJ., Assistant Professor of Air Science and Tactics (1) 1950
M.S., Illinois, 1939

HARALD R. JENSEN, Assistant Professor of Agricultural Economics (1, 2) 1949, 1942
B.A., Buena Vista College, 1938; M.S., Iowa State, 1942; Ph.D., 1950

EDWARD WILLIAM JERGER, Assistant Professor of Mechanical Engineering (1) 1949, 1948
B.M.E., Marquette, 1946; M.S., Wisconsin, 1947; Ph.D., Iowa State, 1951

CARLTON EGBERT JOHNSON, Assistant Professor of Agricultural Engineering (1) 1949, 1947
B.S., Berea, 1938; M.S., Iowa State, 1948

RALPH WALLACE JOHNSON, Assistant Professor of Mathematics (1) 1946
B.S., Franklin College of Indiana, 1911; M.A., Columbia, 1918

*On leave

LLOYD DIEHL JONES, Assistant Professor of Veterinary Pathology, Iowa Veterinary Diagnostic Laboratory, 1949
D.V.M., Iowa State, 1931

MARGARET LOUISE KAGARICE, Assistant Professor of Home Economics; District Home Economics Supervisor (3) 1951, 1946
B.S., McPherson, 1940; M.S., Iowa State, 1946

GEORGE E. KALDENBERG, Assistant Professor of Mathematics (1) 1946, 1943
B.A., Central (Pella), 1921; M.S., Iowa State, 1922

ARNO R. KASSANDER, JR., Assistant Professor of Physics (1, 6) 1950, 1946
B.A., Amherst, 1941; M.S., Oklahoma, 1943; Ph.D., Iowa State, 1950

JOSEPH KASTELIC, Assistant Professor of Animal Husbandry (1, 2) 1950
B.Sc., Alberta, 1943; M.Sc., 1945; Ph.D., Wisconsin,, 1950

JAMES J. KISER, Assistant Professor of Animal Husbandry (1) 1951
B.S., Iowa State, 1942

ARTHUR CHARLES KLEINSCHMIDT, Assistant Professor of General Engineering (1) 1949, 1948
B.B.A., Minnesota, 1938; B.S., Oregon State, 1943; M.S., Minnesota, 1949

EDWIN A. KLINE, Assistant Professor of Animal Husbandry (1, 2) 1949, 1948
B.S., Kansas State, 1942; M.S., Washington State, 1948

O. STEVE KNUDSEN, Assistant Professor of Vocational Education; Visual Aids Production Manager, Information Service (1) 1949, 1948
B.A., Iowa State Teachers, 1931; M.A., Iowa, 1938

HEROLD LANG KOOSER, Director of Visual Instruction (3) 1938, 1924
B.S., Iowa State, 1923

MILLARD R. KRATOCHVIL, Assistant Professor of English (1) 1949, 1946
A.B., Drake, 1940; A.M., Minnesota, 1948

ORLANDO C. KREIDER, Assistant Professor of Mathematics (1) 1945, 1928
B.A., Simpson, 1928; M.S., Iowa State, 1930: M.S., V.Ed., 1941; Ph.D., 1949

RALPH EDWARD KRENZIN, Assistant Professor of Farm Crops (3) 1947
B.S., Kansas State, 1939; M.S., 1947

RUTH M. S. KRISTOFFERSEN, Assistant Professor of Library Science and Head, Reference Department (1) 1947, 1943
A.B., Oregon, 1942; B.S.L.S., Denver, 1943

JOHN E. LAGERSTROM, Assistant Professor of Electrical Engineering (1, 4) 1949, 1946
B.S., (E.E.), Iowa State, 1944; M.S., 1951

ROBERT W. LAMSON, Assistant Professor of Physical Education for Men (1) 1949
B.S., Iowa State, 1928

EDWARD P. LANA, Assistant Professor of Horticulture (2) 1947
B.S., Minnesota, 1942; M.S., 1943; Ph.D., 1948

*CARL E. LANGENHOP, Assistant Professor of Mathematics (1) 1949, 1944
B.A., Louisville, 1943; M.S., Iowa State, 1945; Ph.D., 1948

*JORDAN LOUIS LARSON, Assistant Professor of Mechanical Engineering (1) 1950, 1947
B.S., Iowa State, 1947; M.S., 1948

HARLAND S. LAYCOCK, MAJ., Assistant Professor of Air Science and Tactics (1) 1949, 1948
B.S., Purdue, 1940

THOMAS S. LEITH, Assistant Professor of Animal Pathology (2) 1941, 1916
D.V.M., Iowa State, 1914

LOUIE L. LEWIS, Chief Engineer, WOI FM-TV, 1947, 1939
B.S., Iowa State, 1931

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FRODE E. LIND, Assistant Professor of Botany (1) 1950, 1947
Diploma, Oslo, 1943; M.S., Iowa State, 1947; Ph.D., 1949

CLARENCE H. LINDAHL, Assistant Professor of Mathematics (1) 1947
B.S., Nebraska State Teachers, 1929; M.S., Colorado, 1935

ARNOLD RUFUS LIVINGSTON, Assistant Professor of Theoretical and Applied Mechanics (1) 1946, 1942
B.S. (Arch.E.), Iowa State, 1926

JAMES ALLISON LOWRIE, Assistant Professor of English (1) 1946
A.B., Lafayette, 1935; Ph.D., Pittsburgh, 1943

MICHAEL J. MCCARTHY, CAPT., Assistant Professor of Military Science and Tactics (1) 1950
B.S., Colorado State, 1937

DALE MCCAY, Assistant Professor of English and Speech (1) 1950, 1945
B.A., Grinnell, 1932; M.A., 1937

GAIL ARLENE MCCLURE, Assistant Professor of Hygiene (1) 1938
B.S., Iowa, 1929; M.D., 1931

RICHARD DUNCAN MCCONNELL, Assistant Professor of Architecture (1) 1950, 1947
A.B., Nebraska, 1947; M.S. (Arch.E.), Iowa State, 1950

JAMES E. MCDONALD, Assistant Professor of Physics (1, 6) 1950, 1946
B.A., Omaha, 1944; M.S., Massachusetts Institute of Technology, 1945

LON D. MCGILLIARD, Assistant Professor of Dairy Husbandry (2) 1951, 1948
B.S., Oklahoma A & M, 1942; M.S., Michigan State, 1947

JACK M. MCGUIRE, Assistant Professor of Physical Education for Men (1) 1947, 1941
B.S., Iowa, 1933

RICHARD B. MCHUGH, Assistant Professor of Psychology and Statistics (1, 6) 1950
B.A., Minnesota, 1944; M.A., 1949

HARRIET T. MCJIMSEY, Assistant Professor of Textiles and Clothing (1) 1948, 1944
B.S., Iowa State, 1923; M.A., Columbia, 1931

*JOHN W. MCKIERNAN, Assistant Professor of Mechanical Engineering (1) 1950, 1948
B.S., Missouri, 1947; M.S., Iowa State, 1949

MARJORIE M. MCKINLEY, Assistant Professor of Institution Management (1) 1947
B.S., Indiana, 1940; M.A., Columbia, 1946

RICHARD MCWILLIAMS, Assistant Professor of Animal Husbandry (3) 1946, 1938
B.S., Iowa State, 1938; M.S., 1950

JOHN PETER MAHLSTEDE, Assistant Professor of Horticulture (1, 2) 1951
B.S., Miami, 1947; M.S., Michigan State, 1948; Ph.D., 1951

*HAL W. MAYNOR, Assistant Professor of Mechanical Engineering (1) 1948, 1947
B.S., Kentucky, 1944; M.S., 1947

SARA B. KALAR MERRYMAN, Assistant Professor of Hygiene (1) 1942, 1930
M.D., Keokuk Medical College, 1903

WILLIAM R. MILLARD, Assistant Professor of Chemical Engineering (1, 7) 1950
B.S., Missouri, 1941; M.S., 1947; Ph.D., Cornell, 1950

BLANCHE ROSE MILLER, Assistant Professor of Home Economics Education (1) 1949, 1946
B.S., Iowa State, 1933; M.S., 1945

GLENN H. MILLER, Assistant Professor of Physics (1, 7) 1948, 1947
B.S., Wake Forrest, 1942; Ph.D., Cornell, 1947

MADGE MILLER, Assistant Professor of Foods and Nutrition (1, 2) 1949, 1939
B.S., Iowa State, 1939; M.S., 1941

PHILIP A. MILLER, Assistant Professor of Farm Crops (2) 1950, 1947
B.Sc., Nebraska, 1943; M.Sc., 1947; Ph.D., Iowa State, 1950

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JACK PARKER MILLS, Assistant Professor of General Engineering (1) 1950, 1947
B.S., Iowa State, 1943; M.S., 1949

WAYNE R. MOORE, Assistant Professor of General Engineering (1) 1947, 1945
B.S. (E.E.), Iowa State, 1942

WILEY BURTON MOORE, Assistant Professor of Physical Education for Men (1) 1947
A.B., Westminster College, Fulton, Missouri, 1928

ANITA MARIE MORTON, Assistant Professor of Child Development (1) 1947, 1944
B.S., Oklahoma A & M, 1942; M.A., Nebraska, 1944

CAMPBELL C. MOSIER, Assistant Professor of Statistics (8) 1947, 1946
B.S., Iowa State, 1944

EDNA ELINOR MUNDT, Assistant Professor of Home Economics Education (1) 1946, 1941
B.S., Iowa State, 1935; M.S., 1943

ALFRED L. MUSSON, Assistant Professor of Animal Husbandry (2) 1951, 1945
B.S., Connecticut, 1933; M.S., Iowa State, 1934; Ph.D., 1951

VERNER HENRY NIELSEN, Assistant Professor of Dairy Industry (1, 2) 1947, 1932
B.S., Iowa State, 1943

*RALPH S. NOVAK, Assistant Professor of Industrial Economics (1) 1949, 1948
B.S., Iowa State Teachers, 1934; M.A., Iowa, 1938

ANN V. NYGAARD, District Home Economics Supervisor (3) 1950, 1936
B.S., Iowa State, 1933

GRACE MYRTLE OBERHEIM, Assistant Professor of Library Science and Head, Order and Exchange Department (1) 1930, 1923
A.B., Wisconsin, 1920; M.S., Columbia, 1941

GLADYS T. OLSON, Assistant Professor of Home Economics Education (1) 1939, 1937
B.S., Iowa State, 1926; M.S., 1936

BERNARD OSTLE, Assistant Professor of Statistics (1, 8) 1949, 1947
B.A., British Columbia, 1945; M.A., 1946; Ph.D., Iowa State, 1949

RICHARD THOMAS OTHMER, Assistant Professor of Theoretical and Applied Mechanics (1, 7) 1947, 1939
B.S. (E.E.), South Dakota State, 1938; M.S., Iowa State, 1947

RAYMOND C. PALMER, Assistant Professor of English (1) 1946
B.S., Oklahoma, 1936; A.M., 1938; Ph.D., Indiana, 1946

ALICE LUCILLE PALUBINSKAS, Assistant Professor of Psychology (1) 1951, 1948
B.S., Massachusetts State Teachers, 1945; M.A., Harvard, 1946

LOYAL COBB PAYNE, Assistant Professor of Veterinary Physiology (1) 1945, 1942
D.V.M., Kansas State, 1941; M.S., Iowa State, 1947

ELLEN PENNELL, Assistant Professor of Technical Journalism (1) 1950, 1926
B.S., Kansas State, 1921

JOHN THOMAS PESEK, JR., Assistant Professor of Soils and Climatology (2) 1950
B.S., Texas A.&M., 1943; M.S., 1947; Ph.D., North Carolina State, 1950

ALDOR C. PETERSON, Assistant Professor of Theoretical and Applied Mechanics (1) 1943, 1938
B.S. (C.E.), Iowa State, 1926; M.S. (C.E.), 1941

DAVID PETERSON, Assistant Professor of Chemistry (1, 7) 1951, 1942
B.S., Iowa State, 1947; Ph.D., 1950

EDWIN WILLIAM PETERSON, Assistant Professor of History and Government (1) 1950, 1946
A.B., Grinnell, 1918; A.M., Iowa, 1926

RICHARD PHILLIPS, Assistant Professor of Agricultural Economics (3) 1951, 1949
B.S., Iowa State, 1948; M.S., 1949

*On leave

FRANK A. PIERSOL, Assistant Professor of Music (1) 1948
A.B., Grinnell, 1933; M.A., Iowa, 1943

J. G. PORTERFIELD, Assistant Professor of Agricultural Engineering (1, 2) 1949, 1947
B.S., Iowa State, 1947; M.S., 1950

LOYD YOST QUINN, Assistant Professor of Bacteriology (1, 6) 1949
B.S., Purdue, 1941; M.S., 1947; Ph.D., 1950

ROBERT FRANKLIN RAUTENSTRAUCH, Assistant Professor of Aeronautical Engineering (1) 1951
B.S. (M.E.), Princeton, 1938; M.S. (Aero.E.), New York, 1941

LUCILLE EMMA REA, Assistant Professor of Textiles and Clothing (3) 1947, 1946
B.S., Illinois, 1933; M.A., Columbia, 1940

GLEN ARTHUR RICHARDSON, Assistant Professor of Electrical Engineering (1) 1947
B.S. (E.E.), Kansas, 1941; M.S. (E.E.), 1947

DAVID D. ROBB, Assistant Professor of Electrical Engineering (1, 4) 1950, 1948
B.S. (E.E.), Kansas, 1943; M.S. (E.E.), 1948

OPAL M. ROBERSON, Assistant Professor of Textiles and Clothing (3) 1950
B.S., Oklahoma, 1926; M.A., Columbia, 1949

FRED ROBERTSON, Assistant Professor of Mathematics (1) 1943, 1927
A.B., Indiana, 1923; A.M., 1927

WLNFIELD S. ROSENBERGER, Assistant Professor of Dairy Industry (1) 1946
B.S., Iowa State, 1940

ESTHER REBECCA RUGLAND, Assistant State Older Youth Leader (3) 1950
B.A., Concordia College, 1933; M.S., Minnesota, 1950

JANE SADDLER, Assistant Professor of Textiles and Clothing (1) 1948, 1944
B.Ed., Illinois State Normal, 1933; M.S., Iowa State, 1945

CHARLES G. SANDERS, Assistant Professor of Engineering Drawing (1) 1951, 1949
B.A., Iowa State Teachers, 1947; M.A., Colorado State, 1949

WAYNE H. SCHOLTES, Assistant Professor of Soils (2) 1950, 1948
B.S., Iowa State, 1939; M.S., Duke, 1940; Ph.D., Iowa State, 1951

JOHN A. SCHULZ, Assistant Professor of Chemistry (2) 1931, 1921
B.S., Illinois, 1917; M.S., Iowa State, 1927

FREDERICK SCHWARTZ, Assistant Professor of Modern Languages (1) 1946
B.A., Iowa, 1935; M.A., 1936; Ph.D., 1948

JAMES W. SCHWARTZ, Assistant Professor of Technical Journalism; News Editor WOI, Information Service 1950, 1945
B.S., Iowa State, 1941

ALBERT DUNCAN SCOTT, Assistant Professor of Soils and Climatology (1, 2) 1950
B.S.A., Saskatchewan, 1943; Ph.D., Cornell, 1949

HARRY L. SHADLE, Assistant Professor of Industrial Economics (1) 1949
B.S., Simpson, 1934; M.A., Iowa, 1940

NAOMI DOROTHY SHANK, Assistant Professor of Home Management (3) 1949, 1945
B.S., Iowa State, 1945

STANLEY K. SHAPIRO, Assistant Professor of Bacteriology (1, 6) 1949
B.S., McGill 1944; M.S., 1945; Ph.D., Wisconsin, 1949

ARDEN F. SHERF, Assistant Professor of Botany (1, 2, 3) 1949
B.S., Minnesota, 1939; Ph.D., Nebraska, 1948

CHARLES H. SHERWOOD, Assistant Professor of Horticulture (2, 3) 1949, 1941
B.S., Iowa State, 1939; M.S., Ohio State, 1941

EMERSON W. SHIDELER, Assistant Professor of Religious Education (1) 1950
A.B., Pittsburgh, 1937; B.D., Chicago Theological Seminary, 1940; Ph.D., Chicago, 1948

HARRISON SHULL, Assistant Professor of Chemistry (1, 7) 1949
A.B., Princeton, 1943; Ph.D., California, 1948

JAMES A. SLATER, Assistant Professor of Zoology and Entomology (1) 1950, 1947
B.A., Illinois, 1942; M.S., 1947; Ph.D., Iowa State, 1950

MARGARET W. SLOSS, Assistant Professor of Veterinary Pathology (1) 1943, 1923
B.S., Iowa State, 1923; M.S., 1932; D.V.M., 1938

ALICE E. SMITH, Assistant State Girls' 4-H Club Leader (3) 1949, 1947
B.S., Illinois, 1937; M.S., Colorado, 1943

HELEN FLORENE SMITH, Assistant Professor of Mathematics (1) 1945, 1907
A.B., Cornell, 1902; M.S., Iowa State, 1921

MORTON SMUTZ, Assistant Professor of Chemical Engineering (1, 7) 1951
B.S., Kansas State, 1940; M.S., 1941; Ph.D., Wisconsin, 1950

STYRL V. SNYDER, Assistant Professor of Industrial Safety (5) 1948
B.A., Illinois, 1939

NORMAN JOHN SOLLENBERGER, Assistant Professor of Theoretical and Applied Mechanics (1) 1951, 1937
B.S. (C.E.), Kansas State, 1935; M.S. (C.E.), 1936

MAYNARD LYNN SPEAR, Assistant Professor of Veterinary Medicine (3) 1951
D.V.M., Iowa State, 1931

JOHN F. SPEER, Assistant Professor of English (1) 1950
A.B., Oregon, 1945; A.M., 1946; Ph.D., Chicago, 1950

*GEORGE SPRUGEL, JR., Assistant Professor of Zoology and Entomology (1) 1948, 1946
B.S., Iowa State, 1946; M.S., 1947

JANICE STADLER, Assistant Professor of Genetics (2) 1950, 1941
B.A., Montana, 1934; M.A., Wisconsin, 1938

DAVID W. STANIFORTH, Assistant Professor of Botany and Farm Crops (1, 2) 1950, 1947
B.S.A., Saskatchewan, 1944; M.Sc., 1946; Ph.D., Iowa State, 1949

*FREELAND F. STECKER, Assistant Professor of Mechanical Engineering (1) 1949, 1946
B.S. (M.E.), Purdue, 1942; M.S., Iowa State, 1949

KEITH H. STEINKRAUS, Assistant Professor of Bacteriology (1, 2) 1951, 1947
B A., Minnesota, 1939; Ph.D , Iowa State, 1951

EUGENE ELLIOT STISH, MAJ., Assistant Professor of Air Science and Tactics (1) 1951
M.A., Iowa, 1950

GEORGE E. STODDARD, Assistant Professor of Dairy Husbandry (1, 2) 1949
B.S., Idaho, 1943; M.S., Wisconsin, 1948; Ph.D., 1950

HARRY J. SVEC, Assistant Professor of Chemistry (1, 7) 1949, 1941
B.S., John Carroll, 1941; Ph.D., Iowa State, 1950

RICHARD M. SWENSON, Assistant Professor of Soils and Climatology (1, 2) 1951, 1948
B.S., Brigham Young, 1946; M.S., Massachusetts, 1948; Ph.D., Iowa State, 1951

WILLIAM PAUL SWITZER, Assistant Professor of Veterinary Pathology, Iowa Veterinary Diagnostic Laboratory, 1951, 1948
D.V.M., Texas A & M, 1948; M.S., Iowa State, 1951

A. F. TAMSMA, Assistant Professor of Dairy Industry (2) 1949, 1948
B.S., Groningen, Copenhagen, 1933; M.S., 1936; Ph.D., 1938

MARGHERITA TARR, Assistant Professor of Landscape Architecture (3) 1947, 1939
B.S., Iowa State, 1926

ROBERT L. TERRY, Assistant Professor of Zoology and Entomology (1) 1951
A.B., Earlham, 1939; Ph.D., Pennsylvania, 1948

HARVEY E. THOMPSON, Assistant Professor of Farm Crops (1, 2, 3) 1951, 1950
B.S., Wisconsin, 1947; M.S., 1948, Ph.D., 1951

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NELLE E. THOMPSON, Assistant Professor of Foods and Nutrition (1) 1950, 1936
B.S., Iowa State, 1934; M.S., Columbia, 1941.

*JAMES L. THRELKELD, Assistant Professor of Mechanical Engineering (1) 1949, 1947
B.S., Iowa State, 1945; M.S., 1947

BETTY L. TOMAN, Assistant Professor of Physical Education for Women (1) 1951
B.S., Wisconsin, 1948

MARTIN JOHN ULMER, Assistant Professor of Zoology and Entomology (1) 1950
B.S., Michigan, 1942; M.S., 1943; Ph.D., 1950

HERBERT O. USTRUD, Assistant Professor of Civil Engineering (1) 1944, 1939
B.S. (C.E.), South Dakota State, 1937; M.S. (C.E.), Iowa State, 1939

RAYMOND A. VELINE, Assistant Professor of Electrical Engineering (1) 1948, 1943
B.S. (G.E.), Iowa State, 1936; B.S. (E.E.), 1946

DONALD EDWARD VOELKER, Assistant Professor of Dairy Husbandry (3) 1950, 1947
B.S., Iowa State, 1943; M.S., 1950

LAWRENCE W. VON TERSCH, Assistant Professor of Electrical Engineering (1, 7) 1948, 1943
B.S. (E.E.), Iowa State, 1943; M.S. (E.E.), 1948

NORVAL H. WARDLE, Assistant Professor of Agricultural Engineering (3) 1947, 1945
B.S., Idaho, 1937; M.S., 1946; Ph.D., Iowa State, 1949

E. FRANCES WARNER, Assistant Professor of Library Science and Head, Serials Department (1) 1930, 1923
B.A., Ohio Wesleyan, 1912; M.A., 1913; B.S.L.S., Illinois, 1919

EDWARD P. WEGENER, Assistant Professor of Speech (1); Production Manager of WOI, 1947, 1943
B.S., Minnesota, 1938

FRANK E. WELLMAN, Assistant Professor of Vocational Education (1) 1949
B.S., Central Missouri State, 1939; M.A., Missouri, 1941

MILDRED K. WELLMAN, District Home Economics Supervisor (3) 1948
B.S., Wisconsin, 1922; M.S., Illinois, 1947

ERNEST WENKERT, Assistant Professor of Chemistry (1) 1951
B.S., Washington, 1945; M.S., 1947; Ph.D., Harvard, 1951

KARL WESTER, Assistant Professor of Dairy Industry (3) 1946, 1932
B.S., Iowa State, 1930

OLIVER W. WHITCOMB, Assistant Professor of Veterinary Surgery (1) 1951, 1949
D.V.M., Iowa State, 1949

MERL I. WHORLOW, Assistant Professor of Agriculture (3) 1950
A.B., Nebraska State Teachers, 1936; M.P.H., Michigan School of Public Health, 1946

SAMUEL C. WIGGANS, Assistant Professor of Botany and Farm Crops (1, 2) 1951
B.S., Nebraska, 1947; M.S., Wisconsin, 1948; Ph.D., 1951

ELEANOR S. WILKINS, Assistant Extension Editor (3) 1943, 1936
B.S., Oregon State, 1919

BENJAMIN S. WILLIS, Assistant Professor of Electrical Engineering (1) 1927, 1924
B.S. (E.E.), Minnesota, 1917; E.E., Iowa State, 1926; M.S. (E.E.), 1929

LAWRENCE H. WILLSON, Assistant Professor of Physics (1) 1920, 1919
A.B., Valparaiso, 1913; B.S., Chicago, 1914

DWIGHT X. WILMETH, CAPT., Assistant Professor of Military Science and Tactics (1) 1950
B.S., Nebraska Teachers, 1950

EVELYN G. WIMERSBERGER, Assistant Professor of Library Science and Head, Catalog Department (1) 1946, 1924
A.B., Bates, 1922; B.S., Simmons, 1924; M.S., Columbia, 1939

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FRANK G. WOLLNEY, Assistant Professor of Poultry Husbandry (3) 1951, 1950
B.S., Iowa State, 1950

ROBERT P. WORTHMAN, Assistant Professor of Veterinary Anatomy (1) 1949
D.V.M., Kansas State, 1943

NELSON PAUL YEARDLEY, Assistant Professor of Mathematics (1) 1951
A.B., Lousiana State, 1936; M.S., 1938; M.A., Lehigh, 1940, Ph.D., Cincinnati, 1949

REUBEN A. YELLEN, CAPT., Assistant Professor of Air Science and Tactics (1) 1951
B.S., Colby, 1932

LESTER YODER, Assistant Professor of Chemistry (1, 2) 1931, 1917
B.S.A., Purdue, 1916; M.S., 1917

WILLIAM G. ZMOLEK, Assistant Professor of Animal Husbandry and Agricultural Economics (2, 3) 1948, 1943
B.S., Iowa State, 1944, M.S, 1951

Instructors

CARL E. ADAMS, SGT., Military Science and Tactics (1) 1950
JARLES RALPH ALBERG, Staff Artist (2, 3) 1947
DUANE TAYLOR ALBRECHT, D.V.M., Veterinary Medicine (1) 1951
HAZEL ALLEN, M.A., English and Speech (1) 1945
SAUL ALTSHULER, B.A., Physics (6) 1951
WILLIAM EUGENE AMES, B.S., Technical Journalism (1) 1949
DARLENE ANDERSON, B.S., (7) 1950
DONALD C. ANDERSON, B.S., Information Service, 1951
JACOB PETER ANDERSON, D.Sc., Assistant Curator of Herbarium (6) 1941, 1913
MABEL ANDERSON, B.S., Institution Management (1) 1932, 1926
RUSSELL K. ANDERSON, M.S., Animal Husbandry (1) 1948
STANLEY ROBERT ANDERSON, M.S., Farm Crops (1) 1950
WILLARD RAYMOND ANDERSON, B.S., Agricultural Engineering (1) 1950
ANNE CONNER ARMSTRONG, B.S. (7) 1951
DON F. ATKINS, B.S. (7) 1951
OLIVER CECIL AUCHARD, M/SGT., Air Science and Tactics (1) 1951
AUGUSTUS SIDNEY AYRES, M.S. (7) 1946, 1943
JOYCE V. BABCOCK, B.S., Home Management (1) 1951, 1950
ROBERT Z. BACHMAN, B.S. (7) 1951
ROSELYN MONTGOMERY BANER, B.S., Library Science (1) 1950
PATRICIA ANASTACIA BANACH, B.S., Genetics (1, 2) 1950
JEANNE FRANCES BANISTER, B.S., Household Equipment (1) 1950
GEORGENE VIOLETTE BARTE, M.S., Foods and Nutrition (1) 1951, 1946
MAYNARD PAUL BAULEKE, M.S., Ceramic Engineering (1, 7) 1951
WALLACE ROBERT BAURIEDEL, B.S. (9) 1949
*RICHARD JOSEPH BECK, B.S.L.S., Library Science (1) 1950
GORDON RUSSELL BELL, B.S.A., Bacteriology (1) 1950, 1947
DEAN CLIFTON BENSON, M.S., Mathematics (1) 1950
RAMONA L BETTS, B.S., (7) 1951, 1950
JACK U. BIGGS, M/SGT., Military Science and Tactics (1) 1949
MORTON W. BITTINGER, M.S. (A.E.), Agricultural Engineering (1, 2) 1949
GORDON ELLSWORTH BIVENS, B.S., Agricultural Economics (3) 1951
WARREN K. BLAKE, Dairy Industry (3) 1951

*On leave.

WYATT DEKALB BLAKEMORE, B.S. (M.E.), Engineering Drawing (1) 1950, 1949
JOHN C. W. BLIESE, M.A., Zoology and Entomology (1) 1949
EDWARD E. BORDERS, A.B., (7) 1951
LAURETTA F. BOSTON, B.S., (7) 1951
MARY E. BOTTORFF, B.S., (7) 1951
DAVID RAY BOYLAN, JR., B.S. (C.E.), Chemical Engineering (1, 4) 1949, 1948
HELEN BOZIVICH, M.S., Statistics (1, 2) 1951
R. DEANE BRANSTETTER, M.S., Mathematics (1) 1948
MARIAN BREHM, B.S., (7) 1950
JOHN MADDUX BRIERLY, M.S., (6) 1951, 1950
RALPH E. BRILEY, B.S. (E.E.), (7) 1951
JOHN BRODERICK, ArchE., (7) 1949
MARK HARRISON BROSIER, Acting Supervisor Fireman Training (5) 1951, 1948
*MAURICE R. BRUNSVOLD, Film Editor, Information Service, 1950
GRIFFITH J. BUCK, M.S., Horticulture (1, 2, 3) 1951, 1948
HARRY GLENN BURRELL, M.A., Sports Editor, Information Service, 1941
JAMES H. BUTTS, TV Studio Supervisor, Information Service, 1951
BETTY MAE BYRNES, B.S., Information Service, (3) 1951
F. WAYNE CALDERWOOD, B.S. (7) 1949
TED CAMPBELL, M.S., (6) 1951
BUCHANAN CARGAL, M.S., Mathematics (1) 1950
WILLIAM ALLEN CARLSON, A.B., Geology (1) 1951
GAYEL GLAYDON CARNES, A.B., Theoretical and Applied Mechanics (1) 1944, 1943
ROBERT BEITSCH CAROTHERS, T/SGT., Air Science and Tactics (1) 1951
JANE ANN CARSWELL, B.S., Physical Education for Women (1) 1950
SAMUEL G. CARY, SFC, Military Science and Tactics (1) 1951
EDMUND WEI-KNANG CHENG, M.S., Animal Husbandry (2) 1951
EVERETT L. CHILDS, B.S., (7) 1949
ISABEL LORAINE CHRISTENSEN, M.S., Foods and Nutrition (1, 2) 1951, 1950
WALTER EUGENE CHRYST, B.S., Agricultural Economics (1, 2) 1951, 1949
TING YE CHU, Ph.D., Civil Engineering (4) 1949
CHARLES ALFRED CLARIDGE, B.A., Bacteriology (1) 1950, 1948
NORMAN BROOKS CLEARY, B.S., Economics and Sociology (1, 6) 1951, 1950
MARY A. CLEM, Statistics, (1, 2) 1951, 1925
IOLA ZOE CLEVELAND, B.A., Home Economics Education (1) 1951
ELLIOTT S. CLIFTON, Ph.D., Agricultural Economics (1, 2) 1951, 1949
HILDA LEONA COBB, B.S., Child Development (1) 1951, 1949
ARCHIE NEWTON COLBY, M.S., Psychology (1) 1951
HUBERT E. COLEMAN, M/SGT., Military Science and Tactics (1) 1951
CHESTER CHARLES COLLINS, M.A., Psychology (1, 6) 1951
KARL LEROY CONRAD, M.S., Mathematics (1) 1951, 1947
WELBY G. COURTNEY, Ph.D., (7) 1951, 1950
HAROLD ANDREWS COWLES, B.S. (Chem.E.), General Engineering (1) 1949
ROLLIN J. COWLES, D.V.M., Veterinary Anatomy (1) 1951
CHRISTINE COX, M.S., Child Development (1) 1950
EMOGENE JOYCE CRISS, B.S., Textiles and Clothing (1) 1951
CHARLES VINCENT CRUMB, M/SGT., Naval Science and Tactics (1) 1950

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Q. P. CUMMINGS, FCC, Naval Science and Tactics (1) 1950
*EDMUND L. CURRY, B.S., Agricultural Economics, Assistant Market Editor WOI (3) 1950
CHARLES J. DAUGHERTY, D.V.M., Veterinary Clinics (1) 1951
CHARLES M. DAVIS, M.S. (E.E.), Electrical Engineering (1) 1951, 1950
DONALD M. DAVIS, B.S., Information Service (3) 1951
HAROLD E. DAVIS, M.A., English and Speech (1) 1950
RODNEY J. DAVIS, M.S., (7) 1951
DELLA BUELL DAVISON, M.S., Textiles and Clothing (1) 1951
EDWARD R. DAY, M.A., English and Speech (1) 1949
WESLEY FRANKLIN DECOURSEY, B.S., Chemistry (1) 1946
EDWARD L. DEKALB, B.S., (7) 1951
MERCEDES PETERS DELAHUNT, B.S., Chemistry (1) 1942, 1920
DAVID H. DENNISON, B.S., (7) 1951
EDGAR H. DEWELL, B.S., (7) 1951, 1948
PAUL F. DILJAK, B.S., (7) 1951
ROBERT M. DIMIT, M.S., Sociology (1) 1949
CARROLL C. DOLL, B.S., Horticulture (1, 2, 3) 1951
*WILBUR D. DONALDSON, B.S., Assistant Program Manager, Information Service, 1951, 1948
ELMER ALBERTIS DOUGLAS, M/SGT., Military Science and Tactics (1) 1949, 1946
PAULINE DUDLEY, M.S., Home Economics Education (1) 1950, 1947
MARION DWELLE, B.A., Assistant Editor (2, 3) 1947, 1944
DEAN W. EINSPAHR, M.S., Agronomy (2) 1951
YNDALECIO J. ELIZONDO, B.S. (M.E.), Theoretical and Applied Mechanics (1) 1947
D. D. EVANS, M.S., Soils and Climatology (2) 1950, 1949
BURKETT FARQUHAR, B.S. (E.E.), Assistant TV Manager, Information Service, 1951
MARY FASSEL, (7) 1948
GLENN FAULKNER, B.M.E., (7) 1950
DONALD R. FESSLER, Ph.D., Economics and Sociology (1, 2) 1950, 1947
ARLIN M. FEYERHERM, M.S., Mathematics (1, 6) 1951, 1949
HELEN KING FIDLAR, M.S., Applied Art (1) 1945
MABEL ALICE FLEMING, B.S., English and Speech (1) 1912
THERMAN FRANCIS FLOTA, GMC, Naval Science and Tactics (1) 1950
MARION E. FORSMAN, M.S. (E.E.), Electrical Engineering (1) 1951
CECIL GARFIELD FORTNEY, JR., B.S., Dairy Industry (1) 1950
HENRY DONALD FOTH, M.S., Soils (2) 1948
JANIECE FOTH, B.S., Home Economics (2) 1949
EUGENE NELSON FRANCIS, B.S., Animal Husbandry (3) 1950
PATRICIA LUNDSTEN FRITZ, B.S., Library Science (1) 1950
RICHARD C. FROESCHNER, M.S., Zoology and Entomology (1) 1949, 1948
W. DON FRONK, M.S., Zoology and Entomology (1, 2) 1951, 1948
MARJORIE RUTH FULLER, B.L.S., Library Science (1) 1950
DONALD WILLIAM GADE, M.S. (E.E.), Electrical Engineering (1) 1948
FRANCIS XAVIER GAGNER, ET1, Naval Science and Tactics (1) 1951
MARTHA POLSLEY GAMBLE, B.S., Child Development (1) 1948
FRANKLIN PIERCE GARDNER, M.S., Farm Crops (1) 1950, 1949
CARL GESSER, Mechanical Engineering (1) 1922

*On leave

DALE S. GIBBS, B.S., (7) 1951
RAYMOND C. GIESE, B.S., Chief Announcer, Information Service, 1951
DARREL DEAN GIRTON, B.S. (C.E.), Civil Engineering (1) 1950
ALAN S. GOLDMAN, M.S., Agricultural Economics (2) 1951
DENZIL LYLE GOLEMAN, M.S., Entomology (2, 3) 1951, 1949
RUTH L. GOODLAND, M.S., (7) 1950
ROBERT GOODSTEIN, M.S., Theoretical and Applied Mechanics (1) 1949
FLORINE GOULD, M.S., Child Development (1) 1949
IRMA CAMP GRAFF, Applied Art (1) 1944
DEE MCDONALD GRAHAM, M.Sc., Dairy Industry (2) 1951, 1950
FRANKLIN GRAYBILL, M.S., Statistics (1, 8) 1951, 1950
HEROLD A. GRUETZMACHER, Safety and Job Training (5) 1949
ELSIE ANN GUTHRIE, M.S., Institution Management (1) 1949, 1943
DONALD K. HAAHR, Assistant Engineer of TV Operations, Information Service, 1951, 1949
MELVIN HARVEY HAAS, Engineer, AM Studio Supervisor, Information Service, 1951, 1943
GEORGE A. HALSEY, B.A., News Editor, Information Service, 1951
JEAN LEE HANSEN, M.S., Child Development (1) 1950, 1949
DURWIN M. HANSON, M.S., Vocational Education (1) 1949
JOHN JOSEPH HANWAY, M.Sc., Soils (2) 1950
DELMA E. HARDING, M.S., Zoology and Entomology (1) 1950, 1949
CLARENCE HARPER, B.S. (7) 1949
WILLIAM C. HASKETT, M.S., Botany (2) 1950, 1948
DOROTHY NAUJOKS HAVLIK, M.S.L.S., Library Science (1) 1951
ROBERT JAMES HAVLIK, M.S.L.S., Library Science (1) 1951
GWEN HUNSAKER HAWS, B.S., Technical Journalism (1, 2) 1950, 1949
JOHN F. HEER, B.S., Agricultural Economics (2, 3) 1949
ROBERT H. HEIDEL, M.S., Chemistry (1, 7) 1951, 1943
R. BURNELL HELD, M.S., Agricultural Economics (2) 1951, 1949
JOHN HELLER, B.S., Physics (1) 1951, 1949
JULIA ELLEN HENSLEY, B.A., Assistant Extension Editor (3) 1950
G. RONALD HERD, A.M., Statistics (1) 1951
HENRY J. HETTEL, B.S., (7) 1951
EDITH HEWITT, B.S., Foods and Nutrition (1) 1943
DORIS JUNE HITTLE, M.A., Institution Management (1) 1942
OTTO L. HOFFMANN, M.S., Botany (3) 1949
IMY HOLT, B.S., Botany (1) 1951, 1950
HENRY ALFRED HOMME, M.A., Economics and Sociology (1, 2) 1950, 1949
CHAUNCY EUGENE HOOVER, Engineer, Information Service (Radio) 1950, 1948
PONG RAY HSIA, M.S., Home Economics (2) 1950, 1948
JAMES F. HUFFMAN, M.A., English and Speech (1) 1949
WILLIAM L. HUGHES, M.S., Electrical Engineering (1) 1951, 1949
DONNELL RAY HUNT, B.S., Agricultural Engineering (1) 1951
DAVID VERNON HUNTSBERGER, M.S., Statistics (1, 8) 1951, 1950
NORMAN A. HURLEY, M.S., Bacteriology (2) 1951
THOMAS LIGHTHALL HURST, B.S., Chemistry (2) 1950
JOHN COURTNEY HUSEBY, Staff Artist, Information Service, 1947
CHARLES DENNETT HUTCHCROFT, M.S., Farm Crops (2) 1946

ROBERT KELLY INGHAM, A.B., Chemistry (1) 1951, 1948

CARL EDWARD JACOBSEN, D.V.M., Veterinary Pathology; Iowa Veterinary Diagnostic Laboratory (1) 1951

DONALD GEORGE JEDELE, B.S., Agricultural Engineering (3) 1950

ELROY CLARENCE JENSEN, D.V.M., Veterinary Medicine (1) 1951

ALICE PETERSON JOHNSON, M.S., Home Economics Education (1) 1949, 1947

CURTIS A. JOHNSON, B.S., Agricultural Engineering (1) 1950

HOWARD P. JOHNSON, M.S. (A.E.), Agricultural Engineering (2) 1949

IRA JOHNSON, M.F.A., English and Speech (1) 1951

THEODORE CLARK JOHNSON, M.A., Speech (1) 1951

EARL WAYNE KEHRBERG, B.S., Agricultural Economics (1, 2) 1951, 1949

DOROTHY LOUISE MOTT KELTNER, B.S.L.S., Library Science (1) 1949, 1944

K. ROBERT KERN, B.S., Assistant Extension Editor (3) 1950

EDWARD KERNER, Ph.D., Physics (6) 1951

HARLAN C. KERR, M/Sgt., Military Science and Tactics (1) 1951

JAMES V. KERRIGAN, B.A. (7) 1951, 1948

KEITH K. KETCHAM, B.S. (E.E.), Assistant Engineer (Radio-TV), Information Service, 1951, 1950

CARROLL H. KINKER, M.B.A., Industrial Economics (1) 1949

RALPH WALTER KLOPFENSTEIN, M.S., Mathematics (1, 4) 1951, 1950

CRAIGHTON KNAU, B.S., Assistant Editor (Radio) (3) 1951, 1950

JAMES F. KOERNER, B.S., Physics (6) 1950

DONNA PAHDE KOHNKE, B.S., Household Equipment (1) 1950

PAUL J. KOVACH, M/Sgt., Air Science and Tactics (1) 1949

MARYANN KRECKLOW, M.S., Foods and Nutrition (1) 1950

LAIRD C. KROTZ, B.S. (7) 1950

EMELDA KUNAU, B.S., Applied Arts (3) 1949, 1941

JEAN LUTHER LAFFOON, M.S., Zoology and Entomology (1) 1946

BERNARD D. LAMONT, B.S. (7) 1951

RICHARD P. LATHAM, M/Sgt., Military Science and Tactics (1) 1951

PRISCILLA LA VANWAY, M.S., Child Development (1) 1949, 1947

ROGER L. LAWRENCE, M.A., Assistant State Boys' 4-H Club Leader (3) 1950

ROBERT L. LAWSON, B.S., Engineer, Information Service, 1951

CARL F. LENTZ, M.S. (7) 1951

HOWARD L. LEVINGSTON, S.B. (7) 1951

MARY BETH LIEBERKNECHT, M.A., Mathematics (1) 1948, 1945

ELEANORE A. LOOMIS, M.S, Foods and Nutrition (1) 1951

RACHEL LOWRIE, M.Litt., English and Speech (1) 1946

DOROTHY JEAN MCCART, B.H.Sc., Textiles and Clothing (1) 1951

PAUL EUGENE MCCARTHY, M.F.A., English and Speech (1) 1951

MILDRED EDITH HICKS MCHONE, B.S., Library Science (1) 1947, 1946

MARGARET LUCILE MCKEEGAN, B.S., Assistant Extension Editor (3) 1950, 1944

DONALD I. MCKEOWN, B.S., Architectural Engineering (1) 1949

JOHN CALVIN MCNEE, A.M.L.S., Library Science (1) 1951

HELEN MARIE MADDOCK, B.S., Animal Husbandry (2) 1950, 1949

WALTER E. MADER, B.S. (7) 1951

ANDREW MAITLAND, Mechanical Engineering (1) 1920

EDDIE J. MANTHOS, B.S. (7) 1951

CARROLL W. MARSHALL, E.E., TV Operations Supervisor, Information Service, 1951

David A. Martens, B.S. (7) 1950

Richard Masteller, B.S. (7) 1950

John Mathews, Jr., M.S. (9) 1950, 1946

John R. May, M.S., Chemical Engineering (1) 1950, 1948

Neil H. Mehler, Assistant AM Operations Manager, Information Service, 1951, 1949

Barbara Meyerholz, B.S., Home Economics (2) 1951

Robert L. Mickelson, B.A. (7) 1951

Carl F. Miller, Ph.D. (7) 1951, 1948

Robert Eugene Miller, M.S., Chemistry (1) 1948, 1947

Wayne Sumner Miller, M.S., Industrial Economics (1, 6) 1950

Harlan D. Mills, M.S., Mathematics (1) 1951, 1949

Betty Iverson Monroe, M.S., Applied Arts (1) 1947

John Monroe, B.S., Statistics (6, 8) 1948

Carl Abraham Moon, M.A., English and Speech (1) 1951

Robert Bruce Moorman, M.S., Zoology (3) 1948, 1939

John R. Morgan, B.S. (7) 1951

J. Fred Moyer, M.S., Botany (1) 1951

George H. Muehlbach, M/Sgt., Air Science and Tactics (1) 1950

Wm. J. Mueller, B.S. (7) 1948, 1947

Robert C. Mulhall, B.A., Operations Manager, Information Service (Radio-TV) 1950, 1943

Frances P. Murphy, A.M., Modern Languages (1) 1951, 1942

Janet Louise Navin, B.F.A., Applied Arts (1) 1951

Elaine Nelson, M.A., Bacteriology (1) 1949

Merlene Elma Nelson, M.S., Home Economics Education (1) 1949, 1948

Norman M. Nelson, B.S., Soils (2) 1951, 1950

R. P. Nicholson, B.S., Soils (2) 1949, 1948

James William Nilsson, B.S., Electrical Engineering (1) 1948

Lois Carol Northrop, M.S., Home Economics (2) 1950

Charlotte Ottis, M.A., Modern Languages (1) 1950

William Bryce Palmer, S/Sgt., Air Science and Tactics (1) 1951

Harold Otis Paluska, T/Sgt., Air Science and Tactics (1) 1951

Frank Raymond Parchen, Jr., M.S. (9) 1950

John A. Parks, B.S. (7) 1951

Robert Carl Peabody, B.S., Chemistry (1) 1947, 1946

Wayne Alan Pearce, M.S., Agricultural Economics (3) 1949

Leo Clement Peiffer, B.S. (Arch.E.), Engineering Drawing (1) 1951

Lewis E. Peterson, B.S., Horticulture (3) 1946

Loren W. Peterson, B.S., Assistant Exhibit Specialist (3) 1950

Vivian Alice Peterson, M.A., Library Science (1) 1949

Richard Pinkerton, Ph.D. (7) 1951, 1949

Alma Riemenschneider Plagge, M.S., Home Economics (2) 1948, 1920

Roger A. Porter, SFC, Military Science and Tactics (1) 1951

Ernestine Porterfield, B.S., Foods and Nutrition (1) 1951

Jack E. Powell, B.S. (7) 1946, 1943

Alden Francis Presler, B.S. (Ch.E.), Engineering Drawing (1) 1951

Robert C. Prill, M.S., Soils (2) 1951

Douglas Provow, B.S. (7) 1951

HARRY JEROME PRUSINSKI, SFC, Military Science and Tactics (1) 1951
BEVERLY QUINNEY, B.S. (7) 1950
FREDERICK HERBERT RADKE, B.S., Chemistry (1) 1951, 1947
DWIGHT MENDENHALL RAMSAY, M.A., Economic and Sociology (1) 1951
EARLE S. RAUN, M.S., Entomology (3) 1948
MARY LUCINDA REEDER, M.A., Music (1) 1951
THEODORE LESLIE REID, B.S., Chemistry (1) 1951, 1946
RAYMOND P. REIMAN, Agricultural Economics (3) 1951
WILLIAM ARTHUR REINHART, M.S. (M.E.), Theoretical and Applied Mechanics (1) 1949
OTTO REINHOLZ, Mechanical Engineering (1) 1920
HERBERT WELLINGTON REUBER, D.V.M., Veterinary Obstetrics (1) 1951
WAYNE RHINEHART, B.S. (7) 1950
MILTON JACKSON RIDDLES, M.S. (7) 1950
DAVID JACOB ROBBINS, B.S., Farm Crops (2) 1948, 1945
EVA LANNING ROBBINS, B.S., Library Science (1) 1951, 1944
HARRIETT ROBERTS, M.S., Foods and Nutrition (1, 2) 1943, 1942
RALPH MARION ROBINSON, M.S., Mathematics (1) 1945, 1942
MILTON LANDER ROGNESS, B.Arch., Engineering Drawing (1) 1950, 1940
ALAN ROSS, A.B., Statistics (6, 8) 1951
WALTER CHRISTOPHER ROTHENBUHLER, B.S., Genetics (2) 1950
*JAMES RUSSELL ROWE, B.S. (Aero), Theoretical and Applied Mechanics (1) 1948
KEITH ROYER, Fireman Training (5) 1951
RUTH L. ROYER, B.S., Mathematics (1) 1948, 1947
BETHEL ELEANOR RUST, B.S., Home Economics Education (1) 1951, 1950
ALFRED JOHN SANDBERG, JR., B.S. (E.E.), Electrical Engineering (1) 1951
JUANA KIRCHNER SANDBERG, B.S., Foods and Nutrition (1) 1951
JOE I. SANDERS, M/Sgt., Air Science and Tactics (1) 1951
ROBERT J. SCANNELL, M.L.A., Landscape Architecture (1) 1949
ALLEN EDWARD SCHARK, B.S., Horticulture (1) 1951
FREDERICK A. SCHMIDT, B.S. (7) 1951
JOHN JAMES SCHOLTEN, B.S. (M.E.), Engineering Drawing (1) 1951
RUTH O'DAY SCHONHORST, F.M.A., Applied Arts (1) 1943
HELEN L. SCHULZ, M.S., English (1) 1942, 1926
GLENN ORVILLE SCHWAB, Ph.D., Agricultural Engineering (1, 2) 1947, 1946
SIGMUND SEAMAN, Botany (3) 1948, 1943
ELEANOR LEE SHANLEY, B.S.L.S., Library Science (1) 1949
JOHN B. SHEELER, B.S., Civil Engineering (4) 1951
PAUL H. SIDLES, B.A., Physics (7) 1951, 1948
MALCOLM O. SILLARS, M.A., English and Speech (1) 1949
ROBERT LEE SKINNER, B.S., Agriculture (1) 1951
BERNARD JAMES SLATER, B.Arch., Architecture (1) 1947
FRANK O. SMITH, M.S., Botany (2) 1951
HAROLD G. SMITH, M.S. (7) 1951
MARGARET ELLEN SNODGRASS, B.M., Music (1) 1951
WILBUR SPRAIN, B.S. (7) 1951, 1948
JAMES W. STARBUCK, B.A. (7) 1951

*On leave

ROBERT M. STEWART, JR., B.S., Physics (1, 6) 1949
ALLEN K. STICKEL, S/Sgt., Air Science and Tactics (1) 1951
VERNON FRANCIS STONE, B.Arch., Architecture (1) 1950
CHARLES DEAN STORY, M.S., Animal Husbandry (1) 1950
JOHN H. STRAKA, M/Sgt., M.A., Air Science and Tactics (1) 1947
JOSEPH ANDREW STRITZEL, B.S., Soils (3) 1950
WILLIAM JOSEPH STUCKEY, B.A., English (1) 1951
WILLIAM LESTER SUTTON, T/Sgt., Air Science and Tactics (1) 1951
WILLIAM J. SWARTZ, M.S., Mathematics (1) 1951
*WALTER DAKE TAFT, JR., M.S., Civil Engineering (1) 1949
OUDH BEHARI TANDON, Ph.D., Statistics (2) 1951
VIRGINIA KATHERINE TAYLOR, B.S., Physical Education for Women (1) 1950
ISABELLE ROSE THOMAS, M.S., Foods and Nutrition (1) 1942
LOCHEEN GUNN THOMAS, B.S., Home Economics, Assistant to the Dean of Home Economics; Personnel Officer (1) 1951
*WALTER IVAN THOMAS, B.S., Farm Crops (2) 1950, 1949
DONOVAN JEROME THOMPSON, M.A., Statistics (2, 8) 1950, 1947
MARVIN D. THOMPSON, M.S., Vocational Education (1) 1950
PHYLLIS SHAFER THOMPSON, M.S., Home Economics Education (1) 1950
VICTOR CARL THOMPSON, B.S., Zoology and Entomology (1) 1951
GEORGE W. THOMSON, M.S., Forestry (1) 1947, 1946
LOIS H. TIFFANY, Ph.D., Botany (1, 2) 1949, 1945
INEZ SMITH TUCKER, M.A., Library Science (1) 1951
ARLYN JOYCE VERPLOEG, M.L.S., Library Science (1) 1950
WALTER SAMPSON VINCENT, M.S., Genetics (7) 1951
RICHARD F. VOGL, B.S., Operations Manager, Information Service (Radio) 1951, 1945
MILO D. VOSS, B.S. (7) 1948
ROBERT UHRIG, M.S. (7) 1951
JOHN UHORCZUK WALKER, QMC, Naval Science and Tactics (1) 1951
RICHARD A. WALKER, B.S., Aeronautical Engineering (4) 1949, 1946
RICHARD E. WALKER, M.S., Chemical Engineering (4) 1948
RAY WALRATH, B.S. (7) 1950, 1947
ROBERT J. WALSTROM, M.S., Entomology (3) 1950
RICHARD KURT WALTER, B.S. (E.E.), Electrical Engineering (1) 1947
SCOTT D. WALTON, M.B.A., Industrial Economics (1) 1949
HELEN M. WARD, B.S., Poultry Husbandry (2) 1950, 1947
CLYDE WASSOM, M.S., Agronomy (2) 1951, 1947
ALICE WILLADEAN WATTS, B.S., Physical Education for Women (1) 1950
*RUSSELL V. WATTS, B.S., Agricultural Economics (3) 1949
CHARLES BRUCE WEISER, B.A., Production Assistant, Information Service, 1950
GARNER ELMER WESSMAN, B.S., Bacteriology (1) 1949, 1947
DALE W. WEST, B.S., Botany (1, 3) 1951, 1948
EVERETT M. WHITE, M.S.. Soils and Climatology (2) 1948
THOMAS WILLIAM WICKERSHAM, B.S., Animal Husbandry (3) 1950, 1946
MERLE OLIVER WIENER, M.S., Vocational Education (1) 1948
ELSIE KIMBRELL WILLIAMS, B.S., Textiles and Clothing (3) 1947
JAMES HENRY WILLIAMS, M.S., Farm Crops (2) 1950, 1949

*On leave

TESS W. WILLIAMS, B.S., News Announcer, Information Service (Radio) 1951
VIRGINIA LEE WILTGEN, B.S., Child Development (1) 1950
GORDON WINDERS, B.S., (M.E.) (7) 1950
MILTON WINITZ, B.A., Chemistry (2) 1951, 1948
DEAN CLIFFORD WOLF, B.S., Assistant Extension Editor (3) 1948
DALE LAVERNE WOOLSONCROFT, B.S., Agricultural Engineering (3) 1949, 1941
ELIZABETH ANNE WORDEN, A.B., Music (1) 1950
CARROLL E. WORLAN, B.S., Agricultural Engineering (3) 1950
SHIANG PING YANG, M.S., Home Economics (2) 1949
ROGER RAY YOERGER, M.S., Agricultural Engineering (1) 1949
DALE W. YOUNG, M.S., Botany (2) 1951
FRANK B. YOUNG, B.S., Dairy Husbandry (2) 1951, 1950
JOE HENRY ZALETEL, M.S., Dairy Husbandry (2) 1950
ELAINE CLAIRE ZIMMERMAN, M.A., Modern Languages (1) 1950

Assistants

JOHN GILBERT BOWNE, B.S., Veterinary Anatomy (1) 1950
JOHN GAROLD CLARK, B.S., Psychology (1, 6) 1951, 1950
CHARLES GUY DEAL (9) 1946, 1913
SIDNEY PERCY DEAN, Photographer, Information Service, 1951
STEPHEN FREDERICK DIRKS, B S., Veterinary Pathology (1) 1950
JOHN W. DUNLOP, Film Editor, Information Service (TV) 1951
GRACE S. HOLMES, M.S., Home Economics (1) 1948, 1936
REGINALD NORMAN KJERLAND, B.S , Psychology (6) 1951, 1943
JEANNINE KRUSE, B.S., Information Service, 1951
MEREDITH HARLAN MOORE, B.S , Veterinary Hygiene (1) 1950
GORDON F. MUNSON, B.A , Information Service, 1945
REECE WEBSTER PHILLIPS, B.S.A., Veterinary Physiology and Pharmacology (1) 1950
DIANA E. SEIDEL, Film Editor, Information Service, 1951
QUENTON TERRILL SMITH, B S , Chemistry (2) 1951
MARGARET ELEANOR TAFT, Home Economics Administration, 1950

Graduate Assistants

A. PAUL ADAMS, B.S., Agronomy (2) 1948
JOHN E. ADAMS, M.S., Agronomy (2) 1951
CHARLES E. ALLEN, B.S., Botany (1) 1951
EDWARD E. ANDERSON, B.S. (7) 1951
JOHN ERNEST ANDERSON, M.S., Chemical Engineering (1) 1949, 1948
PHIL E. ARMSTRONG, B.S. (7) 1950
BUELL O. AYERS, B.A. (7) 1949, 1944
M. M. BABBAR, M.A., Statistics (8) 1951
ROBERT S. BAKER, M.S., Chemistry (2) 1951
WILLIAM P. BAKER, M.S., Chemistry (6) 1951
STANLEY L. BALLOUN, B.S., Poultry Husbandry (2) 1951, 1949
JOHN BANISTER, B.S. (7) 1948
GEORGE J. BANWART, B.S., Bacteriology (2) 1951, 1950
DANIEL B. BARKER, B.S. (7) 1949
FRED BARSON, B.S. (7) 1951

NORMAN BARSON, B.S. (7) 1950
RICHARD BARTON, B.S. (7) 1950
JOSEPHINE BARTOW, B.S., Home Economics (2) 1951
MAX BELL, B.S., Botany (1) 1951, 1950
HENRY BINNER, B.S., Chemistry (1) 1951
JOHN MAURICE BIRMINGHAM, S.B. (7) 1951
DONALD JOHN BLANEY, B.S., Chemistry (1) 1949
JULIUS BOCHINSKI, B.S. (7) 1950
JANET ISABEL BOLES, B.S., Zoology and Entomology (6) 1951, 1950
VICTOR WAYNE BOLIE, M.S., Mathematics (1, 6) 1950
WALTER M. BOLLEN, M.S., Chemical Engineering (4) 1950
CURTIS E. BORCHERS, M.S. (7) 1951
WILFRED G. BORDUIN, B.S. (7) 1951
QUENTIN DONNELL BOWERS, B.S., Chemistry (1) 1951, 1950
RICHARD BREHM, B.S. (7) 1949
RAYMOND DALE BRIGHAM, B.S., Farm Crops (2) 1950
C. NORMAN BROWN, B.S., Botany (1) 1951
LOUIS M. BROWN, B.S. (7) 1950
VERNON CARL BULGRIN, B.S., Chemistry (1) 1949, 1948
ALFRED J. BUREAU, M.S. (7) 1951
LEOLA BURFORD, B.S., Institution Management (1) 1950
JOHN PARKMAN BUTLER, A.B., Chemistry (1) 1950
CAROL H. BYRD, B.S. (7) 1949, 1947
ELAINE J. BYRD, A.B. (7) 1950
JAMES A. CALAMARI, B.S., Chemistry (1) 1951
AUGUSTUS GEORGE CALDWELL, M.S.A., Soils and Climatology (2) 1949
ANDERS J. CARLSON, B.S. (7) 1950
ANTON B. CARLSON, M.S. (7) 1949, 1947
HOBART Z. CAMMACK, B.S. (7) 1951
JOHN CARLSON, A.B., Botany (1) 1951, 1950
GRANT CARMAN, M.Sc., Animal Husbandry (2) 1951
REINALDO T. CARRERA, B.S., Chemistry (1) 1951
DONALD S. CARVER, B.S., Poultry Husbandry (2) 1950
LARRY FRED CAVAZOS, M.A., Dairy Husbandry (2) 1950
JOHN CESSNA, B.A., Chemistry (2) 1951
JOHN F. CHAMPAIGNE, JR., B.S., Chemistry (1) 1951
JOHN E. CHILTON, M.S., Botany (1) 1949
FREDERICK CHONG, M.Sc., Mathematics (1) 1951
DARLEANE CHRISTIAN, B.S. (7) 1949, 1947
BERT CLAMPITT, B.S. (7) 1950
GLENN A. CLAYBAUGH, M.Sc., Dairy Industry (2) 1951, 1950
JOSEPH D. CLEMENT, B.S. (7) 1949
ESTEL COBB, B.S., Animal Husbandry (2) 1949
ROBERT M. COHEN, B.Chem.E. (7) 1951
CHARLES C. COOK, JR., B.S. (7) 1949, 1948
JAMES PHILANDER COOK, B.S., Chemistry (1) 1950
H. C. COX, B.S., Entomology (2) 1950
ROBERT P. COX, B.S. (7) 1950

ROY P. CRAIG, M.S. (7) 1949
WILFRED STUART CRAIG, A.M., Entomology (2) 1949
PAUL RODNEY CROWLEY, B.S. (7) 1951
GAROLD W. CURL, B.A. (7) 1951
JAY STEPHEN CURTICE, B.S., Chemistry (1) 1949
DAVID W. CURTIS, B.S. (7) 1949, 1948
THOMAS C. CURTIS, B.A. (7) 1951
LAWRENCE F. DAHL, B.S. (7) 1951
ARTHUR C. DAMASK, B.S. (7) 1951
MALCOLM N. DANA, M.S., Horticulture (2) 1949, 1948
STEVE E. DAVIDSON, B.S., Agronomy (2) 1951
MARION C. DAY, JR., B.A. (7) 1951
BRUCE E. DEAL, A.B. (7) 1950
FREDERICK JOHN DEBBRECHT, B.S., Chemistry (1) 1950
JAMES C. DELOUCHE, B.S., Botany (2) 1950
RALPH R. DENTON, B.A., Botany (1) 1949, 1948
JAMES M. DICKINSON, B.S. (7) 1949, 1948
JOHN A. DOOLEY, A.B. (7) 1950
KATHARINE JANVIER DOUGLAS, M.S., Chemistry (1) 1949
BARRETT DOYLE, B.S., Physics (6) 1951
EDWARD DRECHSLER, B.S., Chemistry (6) 1951
WALTER DROBOT, M.S., Chemical Engineering (4) 1950
PAUL CALVIN DUFFIELD, B.S., Botany (1) 1951
JAMES L. DYE, B.A. (7) 1949
MARVIN EBEL, B.S. (7) 1951
MARGARET ANN EDGAR, B.S., Foods and Nutrition (1) 1951
RICHARD E. EDWARDS, B.S. (7) 1950
ROBERT B. EDWARDS, B.S. (7) 1950
SCOTT HUBERT EIDT, B.S., Chemistry (1) 1951, 1950
ARTHUR LOUIS EISER, JR., B.A., Botany (1) 1951
RUDOLPH HENRY ELLINGER, B.S., Chemistry (1) 1950
JAMES ELLIOTT, B.S. (7) 1949
FRANK O. ELLISON, B.S. (7) 1950
ESTHER EMMONS, B.A., Institution Management (1) 1951
JOHN M. ERICKSON, B.S. (7) 1951
ARTHUR RICHARD ESCHNER, B.S., Forestry (2) 1950
JACK L. EVANS, B.S. (7) 1950
WALTER V. FACKLER, JR., B.S. (7) 1949, 1948
GEORGE M. FARNSWORTH, JR., B.S., Poultry Husbandry (2) 1951
RALPH E. FINKNER, B.S., Farm Crops (2) 1950
DONALD FITZWATER, A.B. (7) 1950
DAVID STANLEY FLIKKEMA, B.A., Chemistry (6) 1951, 1940
JOHN V. FLORIO, B.Ch.E. (7) 1949, 1948
JAMES P. FLYNN, B.S. (7) 1949
RAYMOND A. FOOS, B.S. (7) 1951
JOHN FORD, B.S., Chemistry (1) 1951
JOHN LATIMER FORNEY, B.S., Zoology and Entomology (6) 1951
RICHARD LLOYD FOSKETT, M.S., Horticulture (2) 1949

AUDREY FOWLER, B.S., Home Economics (2) 1951
HAZEL FOX, M.S., Home Economics (2) 1951, 1945
MAX QUENTIN FREELAND, B.S., Chemistry (1) 1949, 1948
GEORGE ALBERT FREEMAN, M.S., Economics and Sociology (1, 6) 1951
WILFORD R. GARDNER, M.S. (7) 1951
LESLIE GATES, M.S., Mathematics (1, 6) 1950, 1948
DAVID WILLIAM GAYLOR, B.S., Statistics (2) 1951
D. STANLEY GEISER, B.S., Technical Journalism (1) 1950
CLARE W. GEROW, B.S., Chemistry (6) 1951
ROBERT GIFFEN, M.S. (7) 1947
JAMES PRICE GITTINGER, B.S., Technical Journalism (1) 1951
LOWELL S. GLEASON, M.S., Botany (1) 1951
FOY N. GOFORTH, M.S., Agronomy (2) 1951, 1950
JOYCE PARKER GOFORTH, B.S., Child Development (1) 1951
JACK JOSEPH GOODMAN, B.S., Chemistry (1) 1950
LIONEL GOODMAN, M.S. (7) 1950
EVELYN GORDON, B.S., Home Economics (2) 1951
LEROY F. GRANTHAM, B.S., Chemistry (1) 1951
ALLEN GREEN, M.S. (7) 1951
R. W. GREEN, A.B., Physics (6) 1951
JOHN FOX GRIFFITH, B.A., Chemistry (1) 1951, 1950
DALE GRIMES, M.S. (7) 1951
GERALD GUTER, B.A., Chemistry (6) 1951
RALPH HACH, B.S. (7) 1949, 1948
WINSTON P. HACKBARTH, M.S., Botany (1) 1950
CHESTER EUGENE HAMILTON, M.S., Chemistry (1) 1950
RICHARD L. HANDY, B.S., Civil Engineering (4) 1951
GEORGE F. HANNA, B.S., Chemistry (2) 1951
ROBERT D. HANSEN, B.A. (7) 1950
WILFORD N. HANSEN, B.S. (7) 1951
JAMES ALFRED HAPPE, B.A., Chemistry (1) 1951
HOWARD ALEXANDER HARTZFELD, A.B., Chemistry (1) 1949
ROBERT HARVEY, M.S. (7) 1949
ELLIS WESLEY HAUSER, M.S., Botany (1) 1951
WILLIAM J. HAYLES, B.A. (7) 1950
RICHARD HEDGES, B.S. (7) 1950
DAVID J. HEISER, B.S. (7) 1951
THOMAS J. HENDRICKSON, M.S. (7) 1951
LOIS MAY HENDRIX, B.S., Child Development (1) 1949
KENNETH W. HERRMANN, A.B. (7) 1951
LLOYD HERWIG, M.S. (7) 1950, 1948
DALE M. HILLER, A.B. (7) 1949, 1948
MARVIN HOFFMAN, A.B. (7) 1949, 1948
MARSHA M. HOLLANDER, M.A., Chemistry (1) 1951
NOAH DORTCH HOLMES, B.A., Agricultural Economics (2) 1951
DONALD T. HOOKER, B.S. (7) 1951
DONALD HORROCKS, B.S., Chemistry (1) 1951
FRANCIS JAMES HUGHES, JR., B.S. (7) 1949, 1947
RAY HULET, B.S., Dairy Husbandry (2) 1951

WARREN A. HUNT, M.S. (7) 1951
SIGMUND JAFFE, B.A. (7) 1949
EDGAR MAX JACOBS, B.A., Statistics (8) 1951
FREDERICK JACOBSEN, B.Ch.E. (7) 1951
WILLIAM JOSEPH JAMES, B.S., Chemistry (2) 1950, 1949
FRANK WALTER JANSSEN, B.S., Chemistry (1) 1950
ALDON H. JENSEN, M.S., Animal Husbandry (2) 1950
JAMES T. JONES, JR., B.S. (7) 1951
ROBERT GLENN JOHNSON, B.S. (7) 1949, 1948
ROBERT GUDWIN JOHNSON, B.S., Chemistry (1) 1949
WILLIAM G. JUHL, B.S., Chemical Engineering (4) 1950
JOHN L. KEARNS, B.Ap.Sc., Chemical Engineering (4) 1951
DONALD J. KENNY, B.S. (7) 1948
CLEMENT KEVANE, B.S. (7) 1949, 1948
WARREN DALE KITTS, M.S.A., Chemistry (2) 1950, 1949
RAYMOND M. KLINE, B.S. (7) 1951
DONALD LEO KLIPPENSTEIN, B.A., Mathematics (1) 1950
RICHARD N. KNISELEY, B.A. (7) 1951
JAY KAZUO KOCHI, B.S., Chemistry (1, 6) 1949
ERNEST KOENIGSBERG, B.A. (7) 1949, 1948
ALICE LOUISE KONING, B.A., Zoology and Entomology (6) 1951
KENNETH KOPF, B.S., Genetics (2) 1949, 1930
FRANK A. KOTTWITZ, B.S., Chemical Engineering (1) 1951
FREDERICK RICHARD KUSS, M.S., Botany (2) 1951
WILLIAM FRANCIS KWOLEK, B.S.A., Statistics (2) 1951
RICHARD W. LAITY, M.S., Chemistry (1) 1951
M. REED LAMBERT, M.S., Dairy Husbandry (2) 1951
MALCOLM DANIEL LANE, B.S., Animal Husbandry (2) 1951
RAYMOND LANE, B.S. (7) 1951, 1949
HOWARD J. LARSON, B.S., Dairy Husbandry (2) 1950
PAUL D. LARSON, B.A. (7) 1951
KENNETH LEROY LEBSOCK, M.S., Agronomy (2) 1951
ROBERT CECIL LEFFEL, M.S., Farm Crops (2) 1949
HAZEL LEUPOLD, B.S., Home Economics (2) 1951
DOROTHY BOOTH LEWIS, B.S.. Child Development (1) 1951
LEYBURN FRED LEWIS, B.S., Zoology and Entomology (2) 1951
PAUL H. LEWIS, M.A. (7) 1951, 1948
RICHARD W. LEWIS, B.S., Botany (1) 1951
RUTH EVELYN LITTLEFIELD, B.S., Home Management (1) 1951, 1950
ALBERT LOEFFLER, B.S. (7) 1949
FRED H. LOHMAN, B.S., Chemistry (1) 1951
MARIA GUADALUPE LOMELI, M.A., Statistics (8) 1951
RALPH LOWRY, B.S. (7) 1949, 1948
GEORGE BOND LUCAS, B.S., Chemistry (6) 1949, 1948
RALPH E. LUEBS, B.Sc., Agronomy (2) 1951
HARRY E. LUNT, A.B. (7) 1950
CHAUNCEY EDWARD MCCOY, JR., B.S.A., Zoology and Entomology (1) 1950
ROBERT J. MCDILL, B.S., Botany (2) 1950

RONALD A. MCHAFFEY, B.S. (7) 1951
LYLE MCISAAC, B.A. (7) 1950
GEORGE WINFIELD MCNELLY, B.A., Psychology (1) 1951, 1950
DALE E. MADDEN, M.S., Animal Husbandry (2) 1951
WILLIAM JOHN MAGEE, M.S., Entomology (2) 1950
ROBERT MAITLAND, B.S. (7) 1949, 1948
DALE W. MARGERUM, B.A. (7) 1950
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WARREN I. MITCHELL, M.S. (7) 1951
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RUSSELL F. MITCHELL, B.A. (7) 1951
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JOHN I. MORRISON, A.B., Chemistry (6) 1950, 1949
JOHN WEST MORTON, B.S., Chemistry (1) 1948, 1946
ALFRED W. NAUMANN, A.B. (7) 1951
LEROY F. NELSON, B.S., Animal Husbandry (2) 1951
LINDA JEAN NELSON, B.S., Home Management (1) 1951, 1950
REGINALD DAVID NELSON, B.Sc., Chemistry (1) 1950, 1946
THOMAS DICKEY NEVITT, M.S., Chemistry (1) 1949, 1948
LESTER L. NEWKIRK, M.S. (7) 1949, 1948
ROBERT TED NICHOLS, B.S., Physics (1) 1951
PHILIP NORDIN, B.S.A., Chemistry (1) 1950
MOREY EDMOND OLDWEILER, B.S., Chemical and Mining Engineering (1) 1950
KEITH W. OLSON, B.A., Physics (6) 1951, 1950
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JOHN E. OSHER, B.S. (7) 1951
WENDELL C. OVERHULTS, M.A., Chemistry (6) 1950
JOHN BAXTER OWEN, M.S., Zoology and Entomology (6) 1951
MATHEW PARASOL, B.A., Chemistry (1) 1951
ROBERT WORTH PARK, B.S., Chemistry (1, 6) 1948
EUGENE FORREST PASCHALL, A.B., Chemistry (2) 1949, 1946
ARTHUR PASKIN, B.S. (7) 1949, 1948
OLGA PECHENIUK, B.Sc., Home Management (1) 1950
RODERICK PECK, M.S., Vocational Education (2) 1951
GUSTOF ADOLPH PETERSON, B.S., Economics and Sociology (1) 1950
HOWARD PETERSON, B.S.E. (7) 1949
NORMAN C. PETERSON, S.B., Chemistry (1) 1951
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WARREN EUGENE PICKLUM, M.S., Botany (1) 1951
ARTHUR V. POHM, B.E.S. (7) 1950
ROLLAND PAUL POIRIER, M.S., Genetics (2) 1951, 1950
ROBERT GRANT POLLOCK, B.S., Bacteriology (1) 1951, 1950
DEWEY DONALD POOLE, B.S., Botany (1) 1951
EDWIN LEWIS POOL, M.S., Chemistry (2) 1949, 1946

BARBARA ANN PORTER, B.S., Home Economics (2) 1951
JOHN CHARLES PORTER, M.A., Dairy Husbandry (2) 1950
NORMAN POTTER, B.S., Dairy Industry (2) 1951, 1950
RICHARD MATHER POWERS, B.S. (7) 1949, 1946
ROBERT S. P'POOL, B.S., Chemical Egineering (4) 1951
ROBERT MORRIS PRATHER, JR., M.S., Zoology and Entomology (1, 6) 1950
JOHN H. PRIESTHOFF, B.S. (7) 1951
DAVID W. RACUSEN, B.S. (7) 1950
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NORMAN D. REED, B.S. (7) 1950
THEODORE PAUL REILING, B.S., Horticulture (1) 1951
JAMES J. RENIER, B.S. (7) 1951
JAMES CLARENCE RENNIE, M.S., Animal Husbandry (2) 1950
ALBERT E. RICHARDSON, B.S. (7) 1950
THOMAS JONES ROBERTS, M.S.A., Economics and Sociology (1) 1951
ROBERT ROLIH, B.S., Chemistry (1) 1951
RALPH L. ROLLINS, M.S., Civil Engineering (4) 1951
SANDERS DAVID ROSENBERG, B.A., Chemistry (1) 1948
THOMAS LLOYD ROSENOW, B.S., Forestry (1) 1951
THOMAS D. ROSSING, B.A., Physics (1) 1951, 1950
DAVID D. RUBIS, M.S., Farm Crops (2) 1948
RALPH RUSSI, B.S. (7) 1949
ETSUO SAITO, B.S., Chemistry (1) 1951
RICHARD M. SANDERS, B.S. (7) 1950
EDWARD R. SANFORD, M.S. (7) 1950, 1949
WILLIAM R. SAVAGE, B.S. (7) 1951
JOSEPH CLARENCE SCHAFFNER, B.S., Zoology and Entomology (1) 1951
CHARLES FREDERICK SCHUMACHER, B.S., Psychology (6) 1951
ERMA SCHUMACHER, B.S. (7) 1950
HAROLD RUSSELL SHAW, B.S.A., Agricultural Economics (2) 1950
KERNAL GLENN SHAW, B.S. (7) 1949
WILLIAM C. SHAW, M.S. (7) 1950
MARR D. SIMONS, M.S., Botany (1) 1950
RICHARD SKOCHDOPOLE, B.S. (7) 1949
ARTHUR G. SMITH, A.B., Chemistry (1) 1951
JOHN F. SMITH, B.A. (7) 1949, 1948
NEWTON B. SMITH, M.A., Mathematics (1) 1951
OWEN EDWARD SMITH, B.S., Chemistry (1) 1951, 1950
QUENTON TERRILL SMITH, B.S., Dairy Husbandry (2) 1951
WARREN H. SMITH, M.S. (7) 1950
ALBERT W. SNYDER, B.S. (7) 1951
DONALD SPINK, M.S. (7) 1949
CARL STACY, B.A., Chemistry (1) 1951
EUGENE E. STAFFELDT, M.S., Botany (1) 1949
DORIS V. STAGE, B.A., (7) 1949, 1948
PHILIP R. STEIN, M.S., Botany (2) 1950
MELVIN D. STERMAN, B.S., Chemistry (1) 1951
EDGAR ERWIN STINSON, B.S., Chemistry (6) 1949, 1948

CHARLES STEPHEN STRINGER, B.S., Bacteriology (1) 1950, 1949
DANTE STIRPE, B.S., Physics (1) 1951
RUSSELL E. SUMMER, B.S., Chemistry (1) 1951
WILLIAM B. SUTTON, B.S., Bacteriology (1) 1948, 1946
GEORGE EDWARD SWAILES, M.S., Zoology and Entomology (1) 1951
DALE SWARTZENDRUBER, B.S., Soil and Climatology (2) 1950
RAYMOND W. TABELING, B.S. (7) 1951
JAMES H. TALBOY, B.S. (7) 1951
JOHN A. TANAKA, B.S., Chemistry (1) 1951
GORDON S. TAYLOR, M.S., Botany (2) 1948, 1947
ROSCOE LEE TAYLOR, M.S., Farm Crops (2) 1948
LEONIDAS BROCKMAN TEBO, JR., B.S., Zoology and Entomology (6) 1951
ROBERT H. THOMAS, M.A., Dairy Industry (2) 1951, 1948
DONALD LORAINE THOMPSON, M.S., Farm Crops (2) 1949
GLYNN O. THRONEBERRY, B.S., Botany (2) 1950
RICHARD LEROY THUMA, B.S., Farm Crops (2) 1950
ROLAND G. TIMIAN, M.S., Horticulture (2) 1950
ROBERT WEARE TODD, B.A., Chemistry (1) 1948
WILLIAM DOUGLAS TOUSSAINT, M.S., Agricultural Economics (2) 1951
GEORGE TRACY, B.A. (7) 1950
ROY WM. VANDER HAAR, B.A. (7) 1949, 1947
RAYMOND VANDERWAL, B.A., Chemistry (1) 1951
WILHELMUS CARL VAN DER ZANT, M.S., Dairy Industry (2) 1951, 1950
HOWARD H. VOELKER, M.S., Dairy Husbandry (2) 1951
EARL P. WADSWORTH, B.S., Chemistry (1) 1951
FAYE ELIZABETH WAHLS, B.S., Child Development (1) 1951
LOWELL LAWRENCE WALLEN, M.S., Chemistry (6) 1948
CHARLES BRADLEY WARD, JR., M.S., Animal Husbandry (2) 1951
GLENN WATERBURY, B.S. (7) 1951, 1949
LAZARUS WEINER, B.A. (7) 1950
ROBERT CHARLES WEISSMANN, B.A., Geology (1, 6) 1951
JOHN B. WEST, B.S. (7) 1950
MARVIN WHATLEY, B.S. (7) 1949, 1948
EARL WHEELWRIGHT, B.S. (7) 1950
GEORGE R. WHITE, B.A., Physics (1) 1951, 1950
WILLIAM C. WHITE, B.S., Agronomy (2) 1951
CHARLES R. WHITSETT, B.S. (7) 1951
FRED H. WIEGMANN, M.S., Agricultural Economics (2) 1951
RONALD ERWIN WILCOX, B.S., Geology (1) 1950
GENE MURIEL WILD, M.S., Chemistry (1) 1948
GENE R. WILDER, B.S., Chemistry (1) 1951
JOHN S. WILEY, B.S. (7) 1951
JOHN T. WILLIAMS, M.S. (7) 1949
VERNON E. WILSON, M.S., Botany (2) 1949
HUGH G. WINTERSTEEN, M.S., Botany (1) 1951
MARJORIE ANN WINTHER, B.A., Botany (1) 1951
WANETA WITTLER, B.S., Home Economics (2) 1951, 1947
JOE DARST WOODS, M.S., Chemistry (1) 1948, 1947

DAVID WORDEN, B.A., Physics (1) 1951, 1950
ANDY J. WYATT, B.S., Poultry Husbandry (2) 1949
IRVIN SANFORD YAFFE, B.A. (7) 1949, 1947
RUTH YAFFE, B.A. (7) 1949, 1948
TSI JEN YANG, B.S., Chemistry (2) 1949
DONALD F. YOUNG, B.S. (7) 1951
WILLIAM JOHN ZIMMERMAN, B.S., Zoology and Entomology (6) 1951
JOHN ARTHUR ZOELLNER, B.S., Statistics (2) 1951

Fellows

ALONZO THEODORE ADAMS, M.S., Bacteriology (2) 1950
FELIX ALBANI, Agronomy (2) 1951
WILLIAM BURL BACK, M.S., Agricultural Economics (2) 1951
FILMORE K. BAGATELL, B.S. (7) 1951
A. GORDON BALL, M.S., Economics and Sociology (1) 1949
LALIT KUNAR N. BHAGWATI, B.S., Agricultural Engineering (2) 1951
LILLIAN BJORCK, B.S., Foods and Nutrition (2) 1950
ROBERT FREDRICK BOLDT, B.S., Psychology (1) 1951
CHARLES STEWART CHANDLER, M.S., Economics and Sociology (1) 1950
IQBAL AHMAD CHAUDHARY, B.Sc., Agricultural Engineering (2) 1951
TIMOTHY KWET-TAH CHIN, B.S.C.E., Civil Engineering (1) 1951
RICHARD R. CLAMPITT, B.S., Psychology (1) 1951
MENDEL D. COHEN, M.S., Chemistry (1) 1951
ROBERT JOHN CORNWELL, B.S., Agricultural Economics (2) 1951
WILLIAM DARCOVICH, M.S., Agricultural Economics (2) 1951
CHARLES H. DAWSON, M.S., Electrical Engineering (1) 1951
JUSTIN W. DIEHL, B.S., Chemistry (1, 6) 1951
EARLE MILTON DOUGLAS, B.S., Zoology and Entomology (1) 1950
WILLIAM LAWRENCE DOWNES, JR., B.S., Zoology and Entomology (1) 1950
EDDIE VEE EASLEY, M.S., Agricultural Economics (2) 1951
JOHN ELLINGBOE, B.S., Chemistry (1) 1951
JOHN ELLISON, B.S., Chemistry (1) 1951
JOHN E. FISHER, B.S.A., Botany (1) 1950
MARILYN LOUISE FOX, B.A., Psychology (1) 1951
PAUL ARNOLD FRYXELL, M.S., Genetics (1) 1951
PILAR GARCIA, M.S., Home Economics (2) 1951
ROBERT FRANCIS GILTNER, B.S., Geology (1) 1951
SAMUEL KNAPP GOODEN, B.S., Zoology and Entomology (2) 1951
CARROLL ROBERT GRONDAHL, B.S., Entomology (2) 1950
MERRILL JOHNSON HALLAM, A.B., Soils and Climatology (2) 1950
DEAN HARPER, B.S., Mathematics (1) 1951
DONALD HUGH HOGLE, M.S., Chemistry (1) 1951, 1950
ROBERT N. HOLCOMB, M.S., Civil Engineering (4) 1951
ROBERT Y. H. HSU, B.S., Botany (1) 1951
FRED HARVEY HUBBARD, B.S., Entomology (2) 1950
HENRY J. HUDEK, B.S.A., Agricultural Economics (2) 1951
DANIEL HARTZ HUG, B.S., Bacteriology (1, 6) 1949
RUPPERT H. HUNZIKER, M.S., Soils and Climatology (2) 1948

RICHARD E. JOHNSON, B.S., Mathematics (1) 1951
ARTHUR ALONZO KARWATH, B.S., Mathematics (1) 1950
LEE R. A. KOLMER, B.S., Agricultural Economics (2) 1951
MITCHELL KORZENOVSKY, A.B., Bacteriology (1, 6) 1951
ALLEN ABRAHAM KRAFT, M.S., Bacteriology (2) 1949
WALLACE CLAYTON LAWTON, M.Sc., Dairy Industry (2) 1951
GRENDEL ERDEN MCKIMPSON, M.S., Animal Husbandry (2) 1951
LESTER VINCENT MANDERSCHEID, B.S., Agricultural Economics (2) 1951
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GEORGIA RAE MAXSON, B.S., Psychology (1) 1951
PAUL HERMAN MONSON, B.A., Botany (1) 1951
JOHN BARSTROW MORRELL, JR., B.A., Botany (1) 1951
SELIM A NASHIF, M.S., Dairy Industry (2) 1949
ROBERT LEE NICHOLLS, B.S.C.E., Civil Engineering (1) 1951
MURIEL TOWNSEND ORTMEYER, B.S., Child Development (1) 1950
JOHN LEWIS OTT, M.A., Bacteriology (1, 6) 1951
KENNETH OTTIS, B.A., Zoology and Entomology (6) 1951
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CHARLES E. REEDER, B.S., Chemistry (1) 1951
MIRIAM SCHWARTZ, B.A., Bacteriology (1) 1951
CHARLES EDWIN SHELBY, M.S., Animal Husbandry (2) 1950
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TRAVIS STEVENS, B.A., Chemistry (1) 1951
JAMES A. STONE, B.A., Psychology (6) 1951
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ENN TATAR, B.A., Mathematics (1) 1951
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HAROLD LINCOLN ZIMMACK, B.S., Zoology and Entomology (1) 1951
HAROLD LEE ZIMMERMAN, B.S., Geology (1, 6) 1950

Industrial Fellows

HAROLD C. ARVIDSON, JR., B.S., Chemical Engineering (4) 1951
WESLEY FISHER BUCHELE, M.S., Agricultural Engineering (2) 1951
LEOLA FORD, M.S., Botany (1) 1951
OSCAR F. HOBART, JR., B.S., Botany (2) 1951, 1950
GEORGE HOPKINS, M.S., Physics (1) 1951, 1950
FRANK BRISTOL LANHAM, M.S., Agricultural Engineering (2) 1950, 1935

THOMAS CLEMENT LOOMIS, B.S., Chemistry (6) 1951, 1948
DOUGLAS R. MURPHY, M.S., Botany (2) 1951
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Robert Burdette Miller, B.S.	Dubuque, Dubuque
Frank Philip Lown, B.S.	Emmet, Estherville
Melvin Christian Wangsness, B.S.	Fayette, Fayette
John Allan Burton, B.S.	Floyd, Charles City
Eber William Eldridge, B.S.	Franklin, Hampton
Warren Dwight Raney, B.S.	Fremont, Sidney
John Melvin Shanda, B.S.	Greene, Jefferson
Ellis Melvin McGrew, M.S.	Grundy, Grundy Center
John Edward Bishop, B.S.	Guthrie, Guthrie Center
Donald Dean Johnson, B.S.	Hamilton, Webster City
Paul Wallace Henderson, B.S.	Hancock, Garner
Richard Dallas Pulse, B.S.	Hardin, Eldora
Paul W. Watts, B.S.	Harrison, Logan
Philip John Baird, B.S.	Henry, Mt. Pleasant
Paul N. Payne, B.S.	Howard, Cresco
Paul Darwin Peterson, B.S.	Ida, Ida Grove
D. H. Zentmire, M.A.	Iowa, Marengo
John Edward Henderson, B.S.	Jackson, Maquoketa
Alvin Frank Yuska, B.S.	Jasper, Newton
Roy Franklin McAllister, B.S.	Jefferson, Fairfield
Harold J. Montgomery, B.S.	Johnson, Iowa City
Joe Emery Legg, Jr., B.S.	Jones, Anamosa
Clair Wayne Baker, B.S.	Keokuk, Sigourney
Albert L. Brown, B.S.	Kossuth, Algona
Delbert T. Foster, B.S.	Lee, Donnellson
Cleon Edward Herriott, B.S.	Linn, Cedar Rapids
Maurice Eugene Eldridge, B.S.	Louisa, Wapello
Taylor Everett Howard, B.S.	Lucas, Chariton
Paul Edward Harms, B.S.	Lyon, Rock Rapids
George Williams Ramsay, B.S.	Madison, Winterset
Eldon James Hans, B.S.	Mahaska, Oskaloosa
Forrest Jesse Kohrt, B.S	Marion, Knoxville
Howard F. Vint, B.S.	Marshall, Marshalltown
Richard Saar Goos, B.S.	Mills, Malvern
Harley Walker, B.S.	Mitchell, Osage
Worley Hal Speers, B.S.	Monona, Onawa
Lloyd Mason Reid, B.S.	Monroe, Albia
Stanley L. Dunn, B.S.	Montgomery, Red Oak
Harold Lewis Craig, B.S.	Muscatine, Muscatine
John H. Longstreet, B.S.	O'Brien, Primghar
Bruce Joseph Florea, B.S.	Osceola, Sibley
Joe Dean Miller, B.S.	Page, Clarinda
Ralph W. Ashby, B.S.	Palo Alto, Emmetsburg
Don P. Carter, B.S.	Plymouth, LeMars
Elmer Ivan Rosenberger, B.S.	Pocahontas, Pocahontas
Grover H. Hahn, B.S.	Polk, Des Moines
Alvin Theodore Goettsch, B.S.	E. Pottawattamie, Oakland

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Richard Hearne Franklin, B.S. . . . . Ringgold, Mt. Ayr
Kenneth R. Littlefield, B.S. . . . . Sac, Sac City
Joseph Raymond Underwood, M.A. . . . . Scott, Davenport
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Dwayne Arnold Rohweder, B.S. . . . . Sioux, Orange City
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G. Gress Rogers, B.S. . . . . Tama, Toledo
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John Richard Rukgaber, B.S. . . . . Wapello, Ottumwa
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S. G. Vickerstaff, M.S. . . . . Woodbury, Sioux City
Wm. H. St. Clair, B.S. . . . . .Worth, Northwood
Aaron R. Bowman, B.S. . . . . Wright, Clarion

Assistant County Extension Directors

(Soil Conservation)

*Lowell Benjamin Johnson, B.S. . . . . Shelby, Harlan
Curtis John Overdahl, M.S. . . . . Three Counties, Primghar
*Robert Allen Smith, B.S. . . . . Cherokee, Cherokee
Clifford Duane Spies, B.S. . . . . Page, Clarinda

District Extension Directors

(Soil Conservation)

William F. Bennett, B.S. . . . . Cedar Rapids
Rorert Copping Gray, B.S. . . . . Mt. Pleasant
Virgil Kenneth Webster, B.S. . . . . Manchester

County Extension Home Economists

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Cleda Fern Danials, B.S. . . . . Adams, Corning
Adelena Sampson, B.S. . . . . Appanoose, Centerville
Mabel Wilson Flint, B.S. . . . . Audubon, Audubon
Nell B. Neill, B.S. . . . . Benton, Vinton
Ramona Esbeck, B.A. . . . . Black Hawk, Waterloo
Carolyn Norberg, B.S. . . . . Boone, Boone
Wilma R. Brommel, B.S. . . . . Buchanan, Independence
Dorcas C. McPherrin, B.S. . . . . Buena Vista, Storm Lake

*On leave.

LeNeita Jean Reigle, B.S. . . . . Butler, Allison
Regina G. Nixon, B.S. . . . . Carroll, Carroll
Betty Jane Bradley, B.S. . . . . Cass, Atlantic
M. Ann Fuhs, B.S. . . . . Cedar, Tipton
Lucille Buchanan, B.S. . . . . Cerro Gordo, Mason City
Carmen L. DeWar, B.S. . . . . Cherokee, Cherokee
Edith Marks Widstrom, B.S. . . . . Clay, Spencer
Evelyn Grace Thiele, B.A. . . . . Clayton, Elkader
Helen Saddoris Whittington, B.S. . . . . Clinton, DeWitt
Marie Mable Bishop, B.S . . . . . Dallas, Adel
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Julia Etta Metier, B.S. . . . . Des Moines, Burlington
Kathryn R. Zahrt, B.A. . . . . Dickinson, Spirit Lake
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Audrey Kaseschke Freitag, B.S. . . . . Grundy, Grundy Center
Carol R. Molln, B.S. . . . . Hamilton, Webster City
Elsie Mae VanWert . . . . . Hancock, Garner
Jacqueline Eleene Dolph, B.S. . . . . Hardin, Eldora
Allene Latta, B.S. . . . . Harrison, Logan
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Myrtle B. Hewitt, B.S. . . . . Humboldt, Humboldt
Alverda Fern James, B.S. . . . . Iowa, Marengo
Jean C. Darrell, B.S. . . . . Jackson, Maquoketa
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Gladys P. Meeker, B.A. . . . . Johnson, Iowa City
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Granda Bid Holleywell, B.S. . . . . Lee, Donnellson
Grace Lucille Bacon, B.A. . . . . Linn, Cedar Rapids
Ada Maxine Wright, B.S. . . . . Lyon, Rock Rapids
Winter Wilson Mackay, B.S. . . . . Madison, Winterset
Mildred L. Bell, B.S. . . . . Marion, Knoxville
Greta W. Bowers, B.S. . . . . Marshall, Marshalltown
Edna Lucille Stubbs, B.S. . . . . Mills, Malvern
Mary Bernadine Neff, B.S. . . . . Muscatine, Muscatine
Evon Louise Meyer, B.S. . . . . O'Brien, Primghar
Ruth Torine Guy, B.S. . . . . Osceola, Sibley
Helen L. Marsh, A.B. . . . . Page, Clarinda
Signora Maria McFadgen, B.A. . . . . Palo Alto, Emmetsburg
Nadine Catron, B.A. . . . . Plymouth, Le Mars
Virginia Lee Harding, B.S. . . . . Pocahontas, Pocahontas
Clarice J. McEvoy, B.S. . . . . Polk, Des Moines
Phyllis Thomsen, B.S. . . . . W. Pottawattamie, Council Bluffs
Mildred Grace Tramel, B.S. . . . . Poweshiek, Brooklyn
Helena Sophia Dilger, B.A. . . . . Scott, Davenport
Phyllis Smith Alvord, B.S. . . . . Sioux, Orange City

JOAN L. SKINNER, B.S. . . . . Story, Nevada
MINA S. OLIN, B.S. . . . . Tama, Toledo
EVELYN MITCHELL HUNTER, B.S. . . . . Taylor, Bedford
EDNA C. MORRIS, M.A. . . . . Van Buren, Keosauqua
BERTHA MAE KELLY, B.S. . . . . Wapello, Ottumwa
MURIEL K. COLLIER, B.S. . . . . Washington, Washington
VERLA BERNARD ULISH . . . . . Webster, Fort Dodge
MARJORIE HELEN FINCHAM, B.S. . . . . Winneshiek, Decorah
ESTHER KLINGEBIEL, B.S. . . . . Woodbury, Sioux City
LETTIE E. ZUBER, B.S. . . . . Wright, Clarion
*BELLE N. CORNELISON (Assistant) . . . . . Ringgold, Mount Ayr
HELEN C. MORLING, M.S., County Extension Home Economist at Large, Ames
ELAINE SCRIBBINS, B.S., County Extension Home Economist at Large, Ames

County Extension Youth Assistants

DONALD ALFRED SHIRK, B.S. . . . . Benton, Vinton
GERALD WILLIAM WENGERT, B.S. . . . . Boone, Boone
JOHN WALKER PATTERSON, B.S. . . . . Cedar, Tipton
RAYMOND H. DIRKSEN, B.S. . . . . Cherokee, Cherokee
LYMAN A. BAILEY, B.S. . . . . Clay, Spencer
WILLIAM CORKERY, B.S. . . . . Clayton, Elkader
*RICHARD LEE CAMPBELL, B.S. . . . . Dubuque, Dubuque
HAROLD L. BOULTON, B.S. . . . . Fayette, Fayette
CARL LOUIS REHDER, B.S. . . . . Franklin, Hampton
*DONALD K. HOTCHKISS, B.S. . . . . Franklin, Hampton
WILLIAM NEIL SUTHERLAND, B.S. . . . . Grundy, Grundy Center
LEE ROYCE VANDEWATER, B.S. . . . . Hardin, Eldora
CALVIN DUANE PERRIN, B.S. . . . . Iowa, Marengo
ELMER F. EGGIMANN, B.S. . . . . Jasper, Newton
ROBERT CHARLES JOHNSON, B.S. . . . . Kossuth, Algona
ROGER WILLIAM CONKLIN, B.S. . . . . Linn, Cedar Rapids
*CHARLES H. EHM, B.S. . . . . Mahaska, Oskaloosa
HUGH SHELDON MORTIMER, B.S. . . . . Marshall, Marshalltown
*JOSEPH EDWARD NARIGON, B.S. . . . . Marshall, Marshalltown
RUSSELL SWENSON, B.S. . . . . Montgomery, Red Oak
JAMES DANIEL NUSS, B.S. . . . . Plymouth, Le Mars
GLEN BERTIL ANDERSON, B.S. . . . . Pocahontas, Pocahontas
DALE MELVIN COCHRAN, B.S. . . . . Polk, Des Moines
*DONALD G. HARMAN, B.S. . . . . Polk, Des Moines
RICHARD WARE MATHEWS, B.S. . . . . W. Pottawattamie, Council Bluffs
MARVIN WALTER BOSS, B.S. . . . . Scott, Davenport
*JAMES R. CHRISTY, B.S. . . . . Story, Nevada
STANLEY RAY STOVER, B.S. . . . . Tama, Toledo
DONALD CLAIRE FURRER, M.A. . . . . Warren, Indianola
LOUIE O. HANSEN, B.S., ... Webster, Fort Dodge
JAMES K. BERNHARDT, B.S. . . . . Winneshiek, Decorah

*On leave.

District Extension Youth Assistant

MILTON M. HENDERSON, B.S. . . . . Ringgold, Mt. Ayr

Farm Management Fieldmen

CHARLES E. DONHOWE, B.S. . . . . Webster City
CHARLES OTTIS GREENLEE, M.S.A. . . . . Clio
DEAN MERLIN HUSTON, M.S. . . . . West Union
LESLIE GEORGE KRAL, B.S. . . . . Cedar Rapids
BUEL F. LANPHER, JR., A.M. . . . . Muscatine
EVERETT GEORGE STONEBERG, B.S. . . . . Denison
WILLIAM JAMES TURNER, B.E. . . . . Sheldon

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1951-1952

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Honors Day—GOWAN, chairman; FITZPATRICK, FOUST, G. W. FOX, IVERSON, LYLE.

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Traffic—SCHAEFER, chairman; LAUER, ROTHACKER, WALKUP, WINFREY; student member, EVERETT M. ROGERS.

Visiting Delegations—LAGRANGE, chairman; A. R. EDGAR, EICHLING, HILLYARD, L. MEYER JONES, SHEERER.

General Information

Historical Summary

In initial influence and aim, the Iowa State College of Agriculture and Mechanic Arts was an outgrowth of the industrial movement in education which sought to provide a training in harmony with the new economic and social order resulting from profound changes in industry and agriculture. Following agitation by state and local agricultural and horticultural societies, on March 22, 1858, a group of young legislators, enthusiastic for popular higher education, secured the establishment of a "State Agricultural College and Model Farm, to be connected with the entire Agricultural Interests of the State," with an appropriation of $10,000 for the purchase and improvement of the lands. Story and Boone counties provided bonds, private subscriptions, and land gifts that more than doubled the appropriation; and a farm of 648 acres upon the open prairies of Story County was purchased. In the succeeding years beginnings were made in developing the farm, but financial depression, confusion of civil strife, and the lack of general interest delayed for a decade the construction of buildings and the beginnings of instruction.

Meanwhile the Morrill Land-Grant College Act of 1862 gave federal aid to industrial education. The Iowa legislature was the first to accept the provisions of the act, September 11, 1862. The College received students for preparatory training October 21, 1868, and the formal opening, with the dedication of the first building and the inauguration of the first president, was on March 17, 1869.

For the first three decades current funds were secured from the land endowment; state appropriations were wholly for capital needs. Since 1900 the legislature has contributed to the educational support. As the state's land-grant institution the College has shared in the supplemental congressional acts for general support—the second Morrill (1890), the Nelson (1907), and the Bankhead-Jones (1935). Until 1909 the government was vested in a separate board of trustees; since that date the control has been in the centralized State Board of Education.

During the formative years the full land-grant program was forecasted—in instruction, research, and extension. The specified lines of agriculture, mechanic arts and military tactics, with appropriate supporting studies, were developed at the start and the range has been progressively expanded to meet changing conditions in the industries and in social organizations. Veterinary instruction was offered to the first class in the agricultural course and in 1879 this study was organized as a separate school—the first in the country to be founded by a state. The College was co-educational from the beginning and a special science course for women was early developed. Instruction in domestic economy was offered in 1872 and in 1875 the nation's first collegiate experimental kitchen was opened.

During the college year 1902-1903 Agriculture, Engineering, Veterinary Science, and Science Related to the Industries (Industrial Science from 1914-1915) were organized into distinct divisions and Home Economics was given this status in 1914-1915. Graduate study has been offered since 1873; the Graduate College was created in 1919.

Following the federal Hatch Act (1887), The Agricultural Experiment Station was founded and the work has expanded with the demands of the occupation

and with the aid of additional federal acts—Adams (1906), Purnell (1925), and Bankhead-Jones (1935)—state appropriations, and special subventions. The Engineering Experiment Station was created by state act in 1904.

Farmers' institutes were conducted by the president and staff as early as 1870 and were continued for three decades. At the beginning of the century short courses were developed to meet general and special needs. The Agricultural Extension Service was created in 1906, and the Engineering in 1913. All phases of the agricultural and home economics extension program have been expanded and systematized by the Smith-Lever (1914) and Capper-Ketcham (1928) Acts. Vocational educational training has been developed to provide instructors and supervisors for the federal-state system established by the Smith-Hughes (1917) and George-Deen (1936) Acts.

While the present designation was anticipated in various administrative reports from the early eighties, the official change of name from "Iowa State Agricultural College and Farm" to the "Iowa State College of Agriculture and Mechanic Arts" was not made until 1896. The College motto, "Science with Practice," was first used by the student publication *The Aurora* in June 1873.

The Presidents of the College have been: Adonijah S. Welch (1868-1883), Seaman A. Knapp (1883-1885), Leigh S. J. Hunt (1885-1886), William I. Chamberlain (1886-1890), William M. Beardshear (1891-1902), Albert B. Storms (1903-1910), Raymond A. Pearson (1912-1926), Raymond M. Hughes (1927-1936), Charles E. Friley (1936-).

Degrees

In the Divisions of Agriculture, Engineering, Home Economics, and Science, the baccalaureate degree conferred is Bachelor of Science. The degree of Bachelor of Architecture is also conferred in the Division of Engineering The degree of Doctor of Veterinary Medicine is conferred upon the completion of the curriculum in veterinary medicine. In the Graduate College the degrees conferred are Master of Science and Doctor of Philosophy. For professional degrees in the Division of Engineering, see page 111.

Co-operative Programs Leading to Two Degrees. The College has co-operative agreements with other colleges and universities whereby, under certain conditions, a student may graduate from both institutions when he transfers to the Iowa State College after study elsewhere. A student should contact the Registrar well in advance of the time he wishes to complete his program.

One plan provides that students who complete the first three years in the curriculum in science and subsequently complete the first year in a medical curriculum in a Class A medical college will be awarded the degree of Bachelor of Science from Iowa State College. By this arrangement the student can reduce to a minimum the time required to earn a Bachelor of Science degree from this College and a degree in medicine from another institution.

A similar plan provides for granting the degree of Bachelor of Science from the curriculum in general engineering upon completion of three years of that curriculum at this College, followed by one year of law in a recognized law college.

Sessions

The college year is divided into four "quarters" approximately twelve weeks in length. These quarters begin in June, September, January and March and are designated as the Summer, Fall, Winter and Spring quarters, respectively.

To accommodate students who cannot attend for the entire period, the Summer Quarter instruction is divided into two six-week terms. Students may enroll for either term or for the full quarter.

Location

Ames is located almost at the geographical center of the state of Iowa, on the main line of the Chicago and North Western Railroad. It is about thirty-five miles north of Des Moines with which it is connected by the Chicago and North Western Railroad. A branch of the Chicago and North Western from Ames serves the northern part of the state. Several bus lines pass through Ames making the city accessible by bus from all sections of Iowa and neighboring states.

Down through the years, the city of Ames has co-operated with the College in maintaining an environment which exerts a wholesome influence upon the student body. The city has an excellent system of public schools, numerous churches, and a good municipal government. Living conditions are very attractive for heads of families who wish to educate their children and enjoy the advantages of living in a college town.

Buildings

Seventy-one buildings for College purposes besides dwelling houses and the buildings for farm stock, machinery, and service departments have been erected by the state for the various departments of the College. The map in the front of the catalogue gives the names of the buildings and their locations.

The Division of Agriculture classrooms, laboratories, and offices are in Curtiss Hall, Dairy Industry Building, Agricultural Annex, Agronomy Building, Genetics Laboratory, Horticultural Building and Greenhouses, Landscape Architecture Studio, Meats Laboratory, Judging Pavilions and Barns, and at the Poultry Farm, Agronomy Farm, Animal Husbandry Farm, Dairy Husbandry Farm, and the Agricultural Engineering Hall and Farm.

The Division of Engineering classrooms, laboratories, and offices are in Marston Hall, Engineering Annex, Industrial Education Shops Building, Electrical Engineering Building, Exhibit Hall, Mechanical Engineering Laboratories, Building A, T. & A. M. Laboratory, Chemical Engineering Hall, Aeronautical Laboratory, and Agricultural Engineering Hall and Farms.

The Division of Home Economics classrooms, laboratories, and offices are in Home Economics Hall, Physical Education Building for Women, Nursery School, and five Home Management Houses.

The Division of Science classrooms, laboratories, and offices are in Beardshear Hall, Botany Hall, Chemistry Hall, Physics Hall, Science Building, Insectary, Armory, Men's Gymnasium and Stadium, Music Hall, Naval Armory, and the Theater Workshop.

The Division of Veterinary Medicine classrooms, laboratories, and offices are in the Veterinary Quadrangle and Stange Memorial Clinic, and at the Veterinary Research Institute Farm.

The Institute for Atomic Research laboratories and offices are in the Metallurgy Building, Chemistry Hall, Physics Hall, the Institute Office and Laboratory Building and the Synchrotron Building.

Many temporary buildings have been constructed on the campus, thus expanding the present facilities to take care of a large student body.

The College Library

The College Library affords an opportunity to students and faculty to have access to the publications needed in their varied activities. The Library's collections now number about 415,000 carefully selected volumes chiefly in the basic and applied sciences. Its collections of periodicals are usually complete in botany, chemistry, entomology, mathematics, physiology, physics, and veterinary medicine. At the present time the Library is receiving over 7,000 periodicals and other serial publications in many languages. Books necessary for class work, research, reference and avocational reading are also included in the collections.

Every feasible means is employed to encourage greater use of the books and facilities of the Library. Reference and Loan librarians make up a public service staff whose chief duty is to see that books and information are secured quickly and efficiently by all who wish them. Both formal and informal instruction in the use of books and libraries are offered to graduate and undergraduate students. Displays of new and outstanding books on various subjects of unusual interest are maintained in the lobbies of the Library throughout the year. Bulletin boards and special display cases are used for exhibits of posters, photographs, and charts. Weekly radio programs over WOI feature reviews and excerpts from books and magazine articles. Additional wings to the Library are planned, which will make possible more adequate Library service to students, members of the faculty and visitors to the campus.

Personnel Service

The Personnel Service is organized for the benefit of the students, the alumni, the faculty, and all organizations and individuals interested in the development of students or in the employment of either students or alumni. The personnel officers are concerned with students as individuals in the process of adjusting to life.

RECORDS. Complete information is secured from each entering student concerning his family, high school record, and practical experiences. A battery of tests measuring scholastic aptitude, silent reading ability, and English training are given at entrance. Scores from these tests are assembled on the student's cumulative personnel envelope and the counselor envelope. During his residence in college complete and detailed information concerning the student is added to his preliminary material.

COUNSELING. Fifty-one counselors have been appointed from the faculties of the various divisions to advise freshman and sophomore students. On entering college each student is assigned to one of these counselors, who, under the direction of the Dean of the Junior College, will aid the student in making his educational and social adjustment to college life. When the student enters the junior year he is assigned to a counselor who is a member of the department in which the student is specializing.

TESTING BUREAU. The Testing Bureau, organized in 1939, serves as a clinical resource in the field of vocational and educational guidance of college students and high school pupils. The program of the bureau is organized to discharge the following general functions: To provide clinical services for the use of college counselors; to carry on educational and vocational counseling with individual

students; to disseminate information about guidance and educational research methodology; to conduct research in the development of guidance instruments and methods.

SOCIAL LIFE. Under the supervision of a social director, a well balanced all-college social program is planned and carried out by the students themselves. Through this medium, the Personnel Service is ready to help the student in developing those traits of personality and character that will not only create a favorable impression but also contribute to his usefulness in later life.

ALUMNI SERVICE. The personnel officers serve the alumni by supplying information concerning positions available. Any alumnus interested in securing employment or in changing his position may write to the personnel service for assistance.

Employment of Students

To assist students in securing part-time employment Iowa State College maintains a student employment office in room 101, Building H. This office accepts applications for part-time employment as well as calls from employers on the campus and in the community. Students and others wishing part-time employment should stop at the employment office and discuss their situation.

A student should not plan to do much outside work the first quarter in school because of the orientation that is necessary to become acquainted with college life. If you are planning to earn a large part of your expenses, it is advisable to carry a light schedule of classes.

Student Health Service

The College recognizes that the development of the body and the establishment of good health standards should go hand in hand with the development and training of the mind. To this end it has established the Student Health Service, whose chief functions may be outlined as follows:

HEALTH EXAMINATION. All new students are required to fill out a health history statement sent to them by the Registrar and, upon admission, are given a physical examination, including a tuberculin test, and a chest X-ray. This is followed with advice, instruction and treatment of those students showing physical defects or health impairments. Yearly chest X-rays are urged.

MEDICAL AND SURGICAL SERVICE. In order to furnish complete medical care and advice for sick students as promptly and conveniently as possible, the College has provided a well-equipped modern hospital and dispensary needed both for the care of students with conditions requiring hospital service and for attention to the lesser ailments that can be cared for in the dispensary without hospitalization.

All students who pay the full registration fee are insured medical and routine nursing service by the College medical and nursing staff in case they come to the hospital or dispensary. Medicines and service, such as X-ray, may be supplied on a cost basis. Students entering the hospital will be given three days' service without charge. For all time in excess of three days per college year, the student is charged a very reasonable rate per day to cover board, room, light and heat. In case a special nurse or physician is employed, the expense shall be borne by the patient.

PREVENTION OF INFECTIOUS DISEASES. An important part of the work of the Health Service is the prevention of epidemic diseases. All such cases are isolated

and contacts with them are kept under such supervision as may be required in accordance with modern epidemiological methods.

The President and the College physicians may require of students entering the College a certificate from a reputable physician showing successful vaccination. It is strongly urged that all students entering Iowa State College be vaccinated for smallpox and receive tetanus toxoid before leaving home.

The College physicians are authorized to exclude from the dormitories and the recitation rooms any person afflicted with a contagious disease, and in case of necessity, those coming in contact with such disease.

Religious Life at the College

The College attempts to provide for its students a wholesome and stimulating spiritual atmosphere. Outstanding religious leaders will be brought to the campus occasionally to address convocations of the student and faculty. An attractive feature of these services is the special music by College musical organizations. Each morning the great hymns of the churches are played on the Stanton Memorial Carillon.

Religion in Life Week is set apart each year in January for discussion in the dormitories and other student residences under the leadership of members of the faculty and for a series of addresses on religion by a prominent clergyman invited to the campus for the purpose.

The Young Men's and Young Women's Christian Associations carry on a program of religious group meetings, discussions and other activities designed to develop the moral and spiritual life of students.

The churches of Ames provide opportunity for worship, participation in church work, wholesome recreational and social activity, and closer personal association with members of the faculty. Several denominations maintain plants and equipment adjacent to the campus which are especially designed for student work.

Concerts

The College artist concert series given each season brings to the campus the country's outstanding artists and musical organizations. During the past season, the series included Alec Templeton, Frances Yeend, two concerts by the Minneapolis Symphony Orchestra conducted by Antol Dorati, and the Norwegian Boys Choir.

In addition to these concerts, the Iowa State College Symphony Orchestra, Concert Band and Glee Clubs present several concerts each year giving renditions of the finest in instrumental and vocal literature. The Festival Chorus presents the "Messiah" the first Sunday in each December.

Lectures

The College brings to the campus each year a wide variety of lectures. Recently the College has adopted the plan of bringing to the campus for several days of lectures and conferences speakers who have won recognition for their creative work and their ability to present effectively the principles of appreciation. Some of the distinguished guests who appeared before student audiences last year were Dan Cooper, Julian Huxley and Marguerite Higgins.

Alumni Association

The Alumni Association of Iowa State College was organized in 1876. Its purpose is to promote the highest interests of the institution and to increase friendship and sympathy among students and alumni. The offices of the association are in Room 232, Memorial Union. Here all Iowa State men and women will find a hearty welcome.

The present officers of the association are:

President, Frank R. Kerrigan, '16, Dubuque, Iowa.

Vice-President, Kenneth Kramer, '40, Vinton, Iowa.

Recording Secretary, Margaret (Stanton) Lange, '30, Ames, Iowa.

Treasurer, J. F. Hall, Ames, Iowa.

Director of Alumni Affairs and Editor, Wallace E. Barron, '28, Ames, Iowa.

The annual meeting and banquet are held commencement week.

Active local branches of the general association exist in all the principal cities of the United States and in various counties in Iowa.

THE ALUMNUS, the official organ of the association, appears bi-monthly under the supervision of the Director of Alumni Affairs.

Alumni Achievement Fund

The Alumni Achievement Fund is an annual giving program sponsored by the Alumni Association for alumni, former students and friends of the Iowa State College. Its purpose is to provide alumni an opportunity to assist in extending the usefulness, privileges and prestige of the College, and to help the College meet needs which would not be satisfied ordinarily through regular appropriations.

The Fund is administered by a board of seven trustees, which appoints the personnel necessary to the conduct of its business.

The present Board and Executive Officers are:

Board of Trustees

John W. Coverdale, '06, Chairman.

V. B. Hamilton, '21, State Board of Education.

Charles E. Friley, President, Iowa State College.

Clay Stafford, '14, Banker.

Madge I. McGlade, '28, Assistant Director of Residence

Leroy D. Snyder, '14, Contractor.

A. A. McLaughlin, '89, Attorney.

Executive Officers

H. H. Kildee, '08, Honorary Chairman.

Earl O. Shreve, '04, National Chairman.

J. F. Hall, Treasurer.

W. E. Barron, '28, Secretary.

E. R. Hergenrather, '40, Director.

Offices for the Alumni Achievement Fund are in Room 232, Memorial Union

Memorial Union

Launched by alumni as a memorial to the service of sons and daughters of the College in World War I, Memorial Union has become a memorial to all Iowa State men and women who have served in the armed forces of our country. It is the student center on the campus. This building and its services give expression to the realization that education includes training for dignified and gracious living as well as preparation for earning a livelihood. Here in a wholesome college-club atmosphere, students, staff members, and alumni mingle in a complex stream of social, recreational, and extra-class activities which supplement and enrich technical training.

Memorial Union is the headquarters of such important campus organizations as the Alumni Association, The Cardinal Guild and the Ward System. Here the Veishea committee plans the annual all-college spring exposition and the Homecoming committee prepares the welcome for alumni returning to alma mater in the fall. Here the alumnus finds a comfortable guest room when he returns to the campus. Great Hall with its lofty ceiling, wide floor, full-sized stage, pipe organ, and varied equipment is the scene of inter-collegiate debates, all-college vespers, student balls, departmental banquets, noonday musicals, student shows, parties, and numerous conferences. The Commons is the informal, between-class meeting place of the student body.

Bowling, table tennis, bridge, checkers and chess are enjoyed by hundreds every day. Music, magazines and art exhibitions provide leisure-time opportunities for informal education and relaxation. Coffee forums, book reviews, panel discussions, conferences, committee meetings, and other Memorial Union activities help to make life at Iowa State a great adventure in twentieth century living.

Fraternities and Sororities

A number of fraternities and sororities have established chapters at Iowa State College with the approval of the college authorities. These groups are subject to rules which have been worked out jointly by these organizations and the faculty. They co-operate with the College in the improvement of scholarship, in the molding of character, and in the all-around development of their members.

The national sororities provide accommodations for approximately 450 women. To be considered for "rushing" and pledging a woman entering Iowa State College without previous college credit is required to have a high school average of at least 2.5. All freshman women are required to live in the dormitories for one year. The average cost of living in a sorority house is $70 a month for each member. This amount pays for board and room, chapter dues, and social obligations. The average initiation fee is $54.

The social fraternities provide homelike surroundings and wholesome food for approximately 1200 men. First-year students who are invited to join may live in fraternity houses. During the past school year, the monthly expenses of members varied from $60 to $70, which included board and room, dues, and social functions. The initiation fee varies from $20 to $70.

The Ward System

The "Ward System" is an organization for men living outside of dormitories and fraternities. It offers its members the opportunity to participate in group activities, both social and athletic. By taking active part in a Ward group, every man in this organization may get the experience necessary for developing qualities of leadership and social poise, and may benefit permanently through acquiring a proper group spirit and co-operative attitude, as well as profit from the healthful recreation of team play and social activity.

The residential area surrounding the College is at present divided into 11 districts or "Wards"; concentrations of population govern the size of each. The business of each Ward group is handled in meetings conducted by its own organization and officers, a faculty man serving as advisor only. In these semi-monthly meetings a complete program of social affairs and athletic contests is sponsored and developed. The activities of the 11 Wards are integrated by seven councils: Executive, Publicity, Social, Intramural, Program, Treasurer, and Activities, composed of representatives of each ward.

All social activities, including dances, parties, and picnics, are under the general supervision of the College Director of Personnel. Athletic events, including touch football, basketball, softball, tennis, horseshoe, are under the supervision of the Director of Intramural Athletics.

Admission to the Ward social and athletic events is by a Ward ticket costing $1.50 for the entire year. Fifty cents of this fee remains with the individual Ward to which the member belongs. The remaining $1 per member is used under the direction of the various councils to defray the necessary expense of the many inter-Ward activities.

Men's Residence Association

The system of men's dormitories operating under College authority is known as the Men's Residence Association. At present Hughes Hall, Friley Hall and the temporary housing units are included in the association which serves approximately 1,300 men. Members are subject to all College rules and in addition there is a system of student government to facilitate group living.

The Association, consisting of a number of "houses", each containing 60 to 90 men, acts as an independent unit complete with its own elected officers. These officers are responsible for promoting the house's social and athletic affairs with other organized College groups. Each house has an upperclassman head resident who serves as the contact between the College administration and the men.

A very active intramural sports program operates the year around giving all men the opportunity to participate in every variety of sport. A sub-Post Office station in Friley Hall handles all mail and express for the men. The location of the men's dormitories is unique in that they are within a few minutes walk of classrooms, laboratories, and sports facilities.

Admission of Undergraduate and Special Students

Basic Preparation for College

The basic requirement for admission to college is graduation from an approved high school. Since not all persons who complete a high school program are adequately prepared for college study, it is desirable that students seeking admission to college will have:

1. Completed a balanced program of studies designed to insure a well-rounded background of knowledge in basic fields
2. Developed proficiency in the use of the English language in reading, writing and speaking
3. Acquired proficiency in basic mathematical skills
4. Developed effective study skills and work habits
5. Developed an adequate intellectual, physical, and social maturity
6. Developed a sincere interest in further formal education.

Some high school graduates, no matter what program of studies they have followed, have not adequately acquired the above qualities; consequently, they are not prepared to do work at the college level.

Although no specific pattern of high school subjects is essential to success in college, there are certain fields of study which, when properly taught, provide an opportunity for the student to secure a general background of primary importance for college study.

The following suggestions are made for the guidance of the high school student who is planning to go to college:

1. ENGLISH. Since the ability to write clearly and to read with understanding and appreciation is essential, it is highly desirable that the student complete three or four units in English.

2. MATHEMATICS. Not only as a tool to further learning but also as a part of basic education, mathematics has much to offer. At least one unit of mathematics (algebra) is required for admission to all curricula. Students planning to specialize in the sciences or in engineering should complete two and one-half or more units in mathematics. See specific requirements for admission, page 76.

3. SOCIAL STUDIES. Social studies—such as history, civics, government, economics, sociology and geography—are basic to the understanding and solution of contemporary problems in the community, in the nation, and in the world. From two to four units may well be devoted to this area.

4. THE SCIENCES. The field is rich in possibilities for understanding the modern world. Two units in science might well be completed. For those who plan to emphasize science or engineering in college, three units would be helpful.

5. FOREIGN LANGUAGES. The prospective college student might well develop a basic reading or speaking knowledge of a modern foreign language. Some background in one of the classical languages would also be desirable.

6. THE FINE ARTS. This field offers opportunity for development in an important area of general education which can contribute much toward individual growth.

7. OTHER SUBJECTS. None of the foregoing statements should be interpreted as meaning that other subjects—agriculture, commercial subjects, home economics, industrial arts, speech, etc.—should be avoided. Such subjects, when properly studied, contribute materially to the educational growth of the individual and prepare him for continued study as well as for the more general activities of living.

Procedure in Applying for Admission

Each student who plans to enter the College for the first time must fill out a formal application for admission which may be secured by writing to the Registrar. The applicant must also file his previous academic records as specified in the following paragraphs:

1. High school graduates with no previous college attendance should forward a complete official transcript of all high school credits, certified by the principal or superintendent of the last school attended.

2. A student who has begun his college work elsewhere should forward (a) a complete official transcript of all high school credits, certified by the principal or superintendent of the last high school attended and (b) a complete official transcript from each college previously attended.

3. Those who are not high school graduates may be admitted to college by examination. If any high school work has been completed, file the record signed by the principal or superintendent of the last school attended. See page 77 for further details.

Applications and credits should be filed not less than two months prior to the opening day of the term the applicant wishes to enter so that there may be adequate time for detailed evaluation of the records. The Registrar will then notify the applicant of his admission status.

Specific Requirements for Admission

I. GRADUATES OF APPROVED IOWA HIGH SCHOOLS. Graduation from an approved high school is the basic requirement for admission to the Iowa State College. A minimum of one unit of algebra is required for admission to all curricula. The requirements for admission to the several Divisions are given below.

(A) DIVISION OF AGRICULTURE. The curricula in forestry, industrial education, and landscape architecture require one and one-half units of algebra and one unit of plane geometry. The curricula in agricultural economics, agronomy and dairy industry require one and one-half units of algebra but do not require plane geometry. The curriculum in agricultural journalism requires one unit of algebra and one unit of plane geometry. All other curricula require one unit of algebra and do not require plane geometry. The requirements for admission to agricultural engineering are the same as for the Division of Engineering.

(B) DIVISION OF ENGINEERING. To fully meet the requirements for admission to the Division of Engineering the student should present one unit of plane geometry, one and one-half units of algebra and either one-half unit of plane trigonometry or an additional one-half unit of algebra. Students who have not completed all of these mathematics courses may take geometry, third and fourth semester algebra or plane trigonometry at the Iowa State College.

It is also highly desirable that the high school student have completed three or four units of English, and all of the mathematics and science courses that are available to him in his high school, since these subjects form the core of the engineering curricula.

(C) DIVISION OF HOME ECONOMICS. One unit of algebra is required. Plane geometry is not required.

(D) DIVISION OF SCIENCE. One and one-half units of algebra and one unit of plane geometry are required.

(E) DIVISION OF VETERINARY MEDICINE. One and one-half units of algebra and one unit of plane geometry are required. For the college subjects required see page 149.

The College uses a literal marking system with the passing marks of A, B, C, and D with corresponding quality points of 4, 3, 2, 1, respectively. The records of all applicants will be averaged on this basis. Iowa residents whose averages are below 2.0 will be admitted on scholastic probation.

II. GRADUATES OF HIGH SCHOOLS IN OTHER STATES. Requirements are the same as in "I" above except that non-Iowa students must have satisfactory scholastic records and must be otherwise acceptable. A nonresident of Iowa must either have made a high school average of at least 2.0 or have graduated in the upper half of his high school class in order to be considered for admission.

III. GRADUATES OF UNACCREDITED HIGH SCHOOLS. Admission will be granted upon demonstration of competence to undertake college work, if the student is otherwise acceptable. In general, the student will be required to make a satisfactory showing in a battery of tests covering general educational attainment and scholastic aptitude

IV. APPLICANTS WHO ARE NOT HIGH SCHOOL GRADUATES. Admission will be granted upon demonstration of competence to do college work, if the student is at least seventeen years of age and is otherwise acceptable. Students who are not beyond high school age will be accepted only upon the high school principal's recommendation that they are mature physically, mentally, and socially.

V. SPECIAL STUDENTS. Mature students who do not wish to become candidates for a diploma or degree, and who do not meet the entrance requirements, may be admitted as special students to pursue courses which they are prepared to undertake. As a basis for admission, evidence of adequate educational accomplishment and approval of the divisional dean concerned will be required.

VI. ADVANCED STANDING. College credits earned in recognized colleges and universities will be given equivalent credit in so far as they apply on the curriculum chosen. Nonresidents of Iowa will not be considered for admission unless their college credits average 2.0 according to the literal marking system set forth in "I" above. Iowa residents whose averages are below "C" may be admitted on scholastic probation. All transfer students will be given an examination to determine their proficiency in the use of English; those who do not use the language clearly and correctly will be required to take remedial work in English without credit.

Freshman Days

For many years Iowa State College has set a short period prior to the opening of the regular college year and designated it as "Freshman Days." This orientation period for new students serves a three-fold purpose: First, to introduce new students to college life and assist them in making the transition from high school; second, to provide a time when certain tests may be given, the purpose of these tests being to furnish to those who are in charge of the counseling and guidance program of the institution such information as will be helpful in planning the student's program; and third, to provide time to register each student in the curriculum he has chosen.

In the Fall of 1952, new students start their work with the first assembly of Freshman Days at 7:45 a. m. on Thursday, September 18.

Parents of new students are cordially invited to visit the campus during Freshman Days. They are particularly urged to hear the opening address by President Charles E. Friley at the first meeting at 8:00 a. m. and to attend the meeting at 10:00 a. m. for parents of students. At the latter meeting parents will have opportunity to meet Dean M. D. Helser and the Junior College counselors.

Fees and Expenses

(Fees are subject to change without notice)

Fees

PAYMENT OF FEES: All fees must be paid on registration day at the beginning of each quarter.

REGISTRATION FEE: The registration fee is $50 per quarter for all divisions of the College. This fee covers the following: Laboratory fees; hospital service; use of library; membership in the Memorial Union; admission to athletic contests, concerts, lectures and debates; subscription to the several student publications.

From the $50 Registration Fee of each undergraduate 35 cents per quarter ($1.05 per year) is allocated to the student publication of his division—The Iowa Agriculturist, The Iowa Engineer, The Iowa Homemaker, The Iowa State Scientist and The Iowa State College Veterinarian—for the student's subscription to the publication.

SUMMER QUARTER FEES: For either term of the Summer Quarter the registration fee is $30. However, the total fee for both terms will not exceed the registration fee for each of the other quarters of the year.

For students with fee reductions (scholars, fellows and graduate assistants) the fee is $15 per term.

For the three-week term the fee is $18.

For the ten-week Summer Camps the fee is $50.

Special and noncollegiate students pay the same registration fee as other students in the division in which they are enrolled.

REGISTRATION FEES FOR STUDENTS WITH FEE REDUCTIONS (SCHOLARS, FELLOWS AND GRADUATE ASSISTANTS): The registration fee is $18 per quarter. This fee covers the following: Laboratory fees, hospital service, use of library, membership in the Memorial Union, and incidentals.

NONRESIDENT TUITION: In addition to the registration fee, all students who are nonresidents of Iowa, except those in the Graduate College, will be charged tuition as follows:

Fall, Winter, and Spring Quarters, each	$70
*Each Term of the Summer Quarter	40

Nonresident tuition is subject to change without notice.

Nonresident tuition is assessed in accordance with the following regulations of the Iowa State Board of Education:

1. *Persons subject to nonresident tuition.* Every nonresident, unless he is registered in the Graduate College, is required to pay nonresident tuition fixed by the Iowa State Board of Education for the work for which he is registering. A student who is required to pay nonresident tuition for a particular quarter

*For the entire Summer Quarter, the total nonresident tuition will be $70

or term will not be entitled to any refund as a result of his subsequently becoming a resident of the state within that quarter.

2. *Nonresident.* "Nonresident" means any person who has not acquired a domicile in the state for purposes independent of attendance at Iowa State College prior to the day on which classes begin for the quarter in which the student first enters the College.

   It will be presumed in all cases in which a nonresident has resided in Iowa less than one year next preceding the opening day of the quarter for which he first registers that he will not have established a domicile for the purpose of attendance at Iowa State College. This statement is not to be construed as meaning that residence of one year's duration will automatically establish the individual as a resident; but if adequate evidence is presented as will prove a present Iowa domicile for such person, resident classification will be granted. An alien domiciled in Iowa who has not made declaration of intention of citizenship, as evidenced by first naturalization papers, shall be classified as a nonresident.

3. *Domicile,* according to the principles announced by the Supreme Court of Iowa, is the place in which a person has a settled connection for legal purposes. In general, these principles are as follows:
   a. Every person has at all times one domicile and no person has more than one domicile at a time. A domicile cannot be lost until another is gained.
   b. The domicile of a wife is that of her husband.
   c. The domicile of the father during his life, and after his death the domicile of the mother, is the domicile of an unmarried minor; but if the father and mother have separate domiciles, an unmarried minor takes the domicile of the parent with whom he lives. If neither parent is living, his domicile is that of the grandparent with whom he lives, if no guardian of his person has been appointed; otherwise, it remains at the place where the parent with whom he lived last was domiciled.
   d. A guardian of a minor cannot change the domicile of a ward to a state other than the one in which the child was domiciled at the time of the guardian's appointment. Recognition will not be given to the guardianship of the person of a minor unless the guardian was appointed in the state in which the child was then domiciled.
   e. It is to be recognized that a student's residence status while he is in attendance at Iowa State College may change. Being classified as a resident at the time of his entrance does not assure the student of the continuation of this status.

4. The Registrar shall decide whether or not the domicile of each student is such as to require him to pay nonresident tuition. Appeal from the decision of the Registrar may be made to a Review Committee. The finding of the Review Committee shall be final.

5. *Evidence*: Burden of proof. The Registrar or the Review Committee is authorized to require such written documents, affidavits, verifications, or other evidences as are deemed necessary to establish the domicile of a student including proof of emancipation, adoption, award of custody, or appointment of a guardian. The burden of establishing that a student is exempt from paying nonresident tuition is upon the student.

FEES FOR LIGHT CLASSIFICATION: Iowa students taking less than nine credits will pay $6 per credit. The minimum charge is $18. By an additional payment of $6.75 per quarter, such students will be entitled to admission to athletic contests,

concerts, lectures and debates, and to subscription to the student publications. Non-resident undergraduate students taking less than nine credits will pay an additional $8 per credit. The minimum tuition charge is $24.

LATE REGISTRATION: An undergraduate student who does not complete his registration and classification on the regular registration days will be required to pay $2 extra if he registers on the day following the last registration day. For each day thereafter $1 is added. The maximum charge is $10.

A graduate student who does not complete his registration and classification by noon of the Saturday following the regular registration days will be charged a late registration fee as follows: If he registers on the following Monday, the fee is $2. For each day thereafter $1 is added. The maximum charge is $10.

MUSIC FEES: Students must register at Music Hall each quarter before they begin their lessons. Students who register late will not be charged for lessons missed because of late registration. All fees are payable at the Treasurer's Office before the registration is complete. Single lessons will be charged at the rate of $2.50.

Voice—10 lessons per quarter	$24.00
Piano—10 lessons per quarter	20.00
Piano—10 lessons per quarter for children under high school age	16.00
Brass and Reed Instruments—10 lessons per quarter	16.00
Harmony, class lessons per quarter	10.00
Violin—10 lessons per quarter	20.00
Organ—10 lessons per quarter	25.00
Violoncello—10 lessons per quarter	20.00
Practice Room, one hour each day of the quarter	5.00
Organ practice, one hour each day for the quarter	8.00

EXPENSES

Residence Halls, Pammel Court, Off-Campus Housing

Eight residence halls provide excellent housing facilities for approximately 1,200 women. Two residence halls plus the annexes provide housing facilities for approximately 1,300 men. Over 1,100 units in temporary structures are available for veterans and their families at Pammel Court.

Each student who desires to live in a residence hall or in Pammel Court is required to deposit $10 with the Director of Residence for the reservation of a room. The deposit will be retained until the room is released at the end of the quarter or at any time of withdrawal from college because of illness or for any reason beyond the student's control. At such time the entire $10 deposit will be refunded, or such portion of it as the condition of the room may justify. If a request for cancellation of the room reservation is not received the deposit will be forfeited. Address all correspondence concerning rooms to the Director of Residence, Friley Hall, Iowa State College, Ames, Iowa.

Residence Halls

The residence halls are operated on the American plan and the fee for the quarter covers room and board. The cost of room and board in the residence halls for the academic year 1952-53 will be about $525. This fee is subject to change depending upon costs. The charge for each term or quarter is payable on registration day. Those applying for accommodations in the residence halls should realize that rooms are rented for the entire academic year.

WOMEN: All undergraduate women are required to secure rooms through the Office of the Director of Residence and to live in residence halls unless special

arrangement is made. Rooms are furnished with single beds and mattresses, chest of drawers, study tables, straight chairs and one pull-up chair. Students furnish their own bedding including mattress pad, pillow and bed linens as well as towels, curtains and throw rugs.

MEN: Rooms in the residence halls are furnished with single doubledeck beds, mattresses, chest of drawers, individual study desks and chairs. Students are expected to furnish their own bedding, including mattress pad, pillow and bed linens as well as towels, curtains and throw rugs.

Pammel Court

The College has provided 1,061 units consisting of trailers, quonset huts, barracks apartments and demountable houses for veterans and their families at Pammel Court, adjacent to the campus. In addition to the above, the College has available 200 lots for rental to students desiring to park private trailers or to construct temporary houses. Detailed information concerning rental of units in the Veterans Housing Project will be sent upon request. Address correspondence to the Director of Residence, Friley Hall, Ames, Iowa.

Off-Campus

Information regarding rooms off-campus may be secured by addressing the Director of Residence, Friley Hall, Iowa State College, Ames, Iowa. New students are advised to arrange for rooms before the opening of the quarter.

The prices of rooms off-campus at present are as follows: Where two occupy a room, $3 to $4 a week for each occupant; where one occupies a room, $3 to $5 a week. Students are expected to furnish their own linens. Board, at the time this goes to press, may be obtained for from $10 to $12 a week. The cost of room and board ranges from $13 to $16 a week.

Each student must arrange for a room before registration. Board may be arranged for by the student after reaching Ames.

For information of students and others interested, the Student Housing Committee has prepared a standard set of requirements for householders furnishing rooms to students. The committee reserves the right to forbid students to room in houses which do not meet these requirements. Copies of the regulations may be obtained by applying to the Director of Residence.

Estimate of Necessary Expenses for the Average Student During His First Year in College

	Agriculture	Engineering	Home Economics	Science		Veterinary Medicine
	Men	Men	Women	Men	Women	Men
Registration Fee	$150	$150	$150	$150	$150	$150
Books and Supplies	60	100*	60	60	60	65
Board and Room	525	525	525	525	525	525
Gym. Suit	5	5	6	5	6	5
Total	$740	$780	$741	$740	$741	$745

Note· Rising food prices may necessitate an increase in the charge for board and room.

Students who are not residents of the state of Iowa should add $210 a year for tuition. Nonresident tuition is subject to change without notice.

*Students who have drawing instruments and a slide rule may deduct from $35 to $40 from this figure.

The above estimates do not include the cost of clothing, transportation, and incidentals. The student's general expenses in addition to the items listed above are subject to the personal habits of the individual and vary according to the degree of economy exercised.

Prospective freshmen should consider carefully the cost of the first year. No one should enter college unless he has money, in his own right, or from friends, to meet his expenses for the freshman year.

Loans and Scholarships

LaVerne Noyes Scholarships for World War I Veterans and Their Descendants: LaVerne Noyes of the class of 1872 left by his will a large portion of the income from his estate to be used in certain colleges and universities for assistance to students who served in World War I or to their descendants. The fund is administered by the Loan Fund Committee of the College. These scholarships are recommended only for students of good standing needing assistance.

These scholarships are not granted until the second quarter in residence. If his first quarter mid-term marks are satisfactory the student may then make application to the Chairman of the Loan Committee.

The Student Loan Office handles two types of loan funds administered by a committee of the faculty. Information concerning either type loan may be obtained from the Director of Student Loans, Room 101, Building H.

Emergency Loans. Loans are available to all students from an emergency fund. Money is loaned through this fund on a short time basis at any time during the quarter provided the student meets the scholastic requirements, and must be repaid before the final examinations for that term are taken.

Graduate Loans. Graduate students may also make loans on a short time basis through the Graduate Loan Fund.

Loans to be Paid After Graduation. Such loans are available to junior and senior students of Iowa and bordering states who have good collegiate records and who meet the other requirements of the committee.

In addition, the following organizations are also assisting students: Federated Women's Clubs, P.E.O. Sisterhood, Knights Templar, Rotary Clubs and churches.

Geneva Scholarship: The Faculty Women's Club contributes $50 toward the expenses of a delegate to the Y. W. C. A. Central Student Conference at Lake Geneva. This fund is awarded each Spring Quarter to a sophomore student. Scholarship, accomplishment in Y. W. C. A. work, interest in general college activities, and personality are the points considered in making the award.

Julia McCulloch Smith Memorial Award: A prize of $25 is awarded to the senior woman making the highest average in scholarship during at least seven consecutive quarters preceding January 1 of her senior year. The award is given only to a student who is unquestionably high in character, in initiative, and in intellectual attainment.

A. A. U. W. Fellowship. The Ames branch of the American Association of University Women offers an annual fellowship which includes tuition, board and room, to a foreign woman student.

Iowa Vocational Rehabilitation Scholarships. The Iowa Vocational Rehabilitation Division of the Iowa Board for Vocational Rehabilitation, Des Moines, Iowa, provides scholarships to disabled civilians who are found to be eligible for training to overcome their handicaps. These scholarships provide free tuition and other assistance to those who are approved for training. Persons with disabilities resulting from birth, disease, accident or from emotional causes may be eligible For further information see the Registrar.

General Regulations

DISCIPLINE: The discipline of the College is confined mainly to dismissing those who prove, on fair trial, to be too independent to submit to needful authority, or too indifferent to take advantage of their opportunities. The final decision in all cases of discipline rests with the President of the College, except when he delegates such power in particular cases to the deans or to some one of the standing committees of the faculty.

JUNIOR AND SENIOR COLLEGE: The Junior College includes all students in the freshman and sophomore classes; the Senior College, all students in the junior and senior classes.

NUMBER OF CREDITS: No student may classify in more than the maximum number of hours allowed in his curriculum per quarter unless by his previous record he has shown exceptional ability. The student will be allowed to drop such extra work only upon permission of the classifying dean; he may be required to drop it in case this or any other work in his schedule is being carried unsatisfactorily.

In general, students failing in any portion of a quarter's work will not be allowed to take full classification for the next quarter.

CLASSIFICATION: No student may be admitted to any class or dropped from it except by authority of the classifying officer. Students may not classify in conflicting courses without the approval of the departments concerned.

Students are required to classify in back studies at the earliest opportunity. Any exception to this rule must be for a good reason and must be approved by the classifying officer.

Before a student may change from one division to another he must secure the approval of the dean of the division to which he wishes to transfer. Before a student may change from one curriculum to another in the same division he must secure the approval of the dean of the division and the head of the curriculum to which he wishes to change. Junior college students must also secure the approval of the Dean of the Junior College.

MARKING SYSTEM: The following system is used by instructors in reporting marks to the Registrar: A, Exceptionally high; B, Superior; C, Average; D, Lowest passing mark; E, Condition; F, Failure; W, Withheld; X, Dropped. For graduate students the lowest passing mark is C. Graduate students may also be given the mark P, Pass, to indicate satisfactory progress in Research, Special Topics or "Required" courses.

QUALITY POINTS: For each credit earned, the student receives quality points, according to the mark attained as follows: A, 4 points; B, 3 points; C, 2 points; D, 1 point; E and F, 0 points.

GRADUATION: A student intending to be graduated shall not be eligible if he lacks at the beginning of his last quarter more credits, not including "Conditions" or "Withhelds," than the number in which he would be entitled to classify as determined by his average for the preceding quarter. A student shall not have the privilege of removing "Conditions" or "Withhelds" or securing substitutions later than the middle of the quarter in which he is to be graduated. No credits will be

accepted after this date for any courses except those included in the classification of the current quarter.

An average of at least 2 quality points per credit in all courses taken is required for graduation.

WITHDRAWAL FROM COLLEGE: If a student severs his connection with the College, he shall obtain an Order to Settle from the Director of Personnel, Room 119, Beardshear Hall. The College will refund the unused portion of the registration fee, deducting 10 per cent for each week of attendance. No refund is made if the student has been in attendance six weeks or longer.

TRANSCRIPT OF RECORD: Any person who has attended College is entitled to a certified statement of the work he has completed. A fee of $1 will be charged for each additional copy.

ENGLISH REQUIREMENTS: Skill in the use of the mother tongue is becoming more and more important. As a result, the College has adopted the policy of granting diplomas only to those students whose written and spoken use of the language measures up to a fair standard of clearness and accuracy. All students are required to take English composition throughout the freshman year and nearly all at least one course in speech subsequently. All seniors must pass an examination in English as a requirement for graduation. Graduate students are required to take a similar examination before registering for their second quarter's work in the Graduate College. Students who transfer from other colleges are required to take an examination in English; those who do not use the language clearly and correctly will be required to take remedial work in English without credit.

After students have completed their required English, they may receive advice and help in maintaining or increasing their skill in the use of the language from members of the Department of English and Speech who serve as the staff of the Writing Clinic, the services of which are available to all sophomores, juniors, seniors, and graduate students. The Speech Clinic, maintained by the Department of English and Speech, is open to all students who wish advice concerning speech problems.

LIBRARY REQUIREMENTS: Independent study and investigation through the use of books and libraries enable students to grow intellectually and professionally in college and afterward. For this reason the College requires all students to be given instruction and practice in how to locate the published literature of their respective major fields of study.

Freshman students receive instruction in the use of books and libraries as a part of their orientation work. Undergraduate students entering with advanced standing are required to take the course required of freshmen unless they have had comparable work elsewhere.

Examinations in Back Work

For matriculated students, examinations in back work will be conducted at the opening of the fall quarter, on September 18 and 19. Information as to the location of the examination may be obtained from the department office.

The examinations are scheduled as follows:

THURSDAY

8:00 A.M. to 10:00 A.M.

Engineering Drawing, Farm Crops, Mining Engineering, Physics, Poultry Husbandry, Zoology.

10:00 A.M. to 12:00 M.

Electrical Engineering, Civil Engineering, Mathematics, Forestry, Geology, Veterinary Medicine, Vocational Education.

1:00 P.M. to 3:00 P.M.

Chemical Engineering, Mechanical Engineering, Military, Landscape Architecture.

3:00 P.M. to 5:00 P.M.

Psychology, Government, History, Religious Education.

FRIDAY

8:00 A.M. to 10:00 A.M.

Animal Husbandry, Ceramic Engineering, Chemistry, Horticulture, Industrial Education, Statistics.

10.00 A.M. to 12:00 M.

Architectural Engineering, Botany, Dairy Industry, Economics, English, Sociology.

1:00 P.M. to 3:00 P.M.

Technical Journalism, Genetics, Home Economics, Theoretical and Applied Mechanics, Speech.

3:00 P.M. to 5:00 P.M.

Agricultural Engineering, Modern Language, Bacteriology, Library, Soils.

For the winter quarter, examinations will be given on January 3, 1953, the hours being the same as given above. For the spring quarter, examinations will be given on March 24, 1953, the hours being the same as above. For the summer quarter, examinations will be given on June 15, 1953, and July 22, 1953. The conflicts will be arranged by the departments concerned.

Division of Agriculture

FLOYD ANDRE, Ph.D., Dean of Division of Agriculture, Curtiss Hall, Room 123N
ROY M. KOTTMAN, M.S., Assistant Dean, Curtiss Hall, Room 122N.

The departments in the Division of Agriculture are: Agricultural Engineering (administered jointly with the Division of Engineering), Agronomy, Animal Husbandry, Dairy Industry, Forestry, Genetics, Horticulture, Landscape Architecture, Poultry Husbandry, Technical Journalism, Vocational Education, and Economics and Sociology (administered jointly with the Division of Science). The faculty of the division is made up of the members of all the departments within the division and representatives of the departments in other divisions whose work serves to prepare agricultural students for a better mastery of technical work in agriculture.

PERSONNEL SERVICE. The agriculture division, through its placement office, supplements and coordinates the efforts made by the departments to establish definite contacts with those industries, commercial organizations, and federal and state agencies that employ men who have had technical training in any of the curricula in agriculture. This service includes the assistance given the members of each graduating class, the alumni and former students who desire to change positions, and the undergraduates who temporarily drop out of college or who seek agricultural or commercial experience during vacation periods.

HONOR FRATERNITIES. There are two national honorary agricultural fraternities that have chapters at the Iowa State College—Alpha Zeta and Gamma Sigma Delta. A chapter of Tau Sigma Delta, an honorary fraternity in the fine arts, selects its membership from the students in Landscape Architecture. Sigma Delta Chi is the honorary fraternity for students in Technical Journalism. Among the other honor fraternities open to students in the Division of Agriculture are the following:

Sigma Xi	All College	Men and Women
Phi Kappa Phi	All College	Men and Women
Mortar Board	All College	Women
Cardinal Key	All College	Men
Phi Eta Sigma	All College	Men

CLUBS. Clubs and agricultural organizations include: Agricultural Economics Club, Agricultural Education Club, Agricultural Journalism Club, Block and Bridle Club, Dairy Club, Dairy Cattle Club, Farm Operation Club, Forestry Club, Horticultural Club, Iowa Student Branch of the American Society of Agricultural Engineers, Poultry Club, Student Section of the American Society of Agronomy, and Student Society of Landscape Architects.

AWARDS. Students of the Division of Agriculture are eligible for special awards and scholarships.

AGRICULTURAL JOURNALISM SCHOLARSHIP. The John Clay Agricultural Journalism Fund provides an income which permits the award of a graduate assistantship in agricultural journalism.

SEARS, ROEBUCK AND COMPANY AGRICULTURAL SCHOLARSHIPS. For the college year 1952-53, Sears, Roebuck and Company have made available to the Iowa

State College an Agricultural Scholarship Fund which will provide several $200 scholarships to freshman students enrolled in the Division of Agriculture. The primary objective of the fund is to make it possible for superior, but financially handicapped, farm boys to get a start of one year in a college of agriculture. The awards will be made to farm boys on the basis of scholarship, need, desire to study agriculture, character, and record of activities.

KNIGHTS OF AK-SAR-BEN SCHOLARSHIP FUND. This fund has been established by the Governors of the Knights of Ak-Sar-Ben, Omaha, Nebraska, to provide financial assistance to farm boys from western Iowa who are working part, or all, of their way through college. Four scholarships, $300 each, will be awarded annually to third quarter freshmen enrolled in Agricultural Economics, Agricultural Education, Agronomy, Horticulture, Animal Husbandry, Dairy Husbandry, Farm Operation, or Poultry Husbandry. One-ninth of the award will be paid at the beginning of each quarter, beginning with the sophomore year, and continuing during the junior and the senior years so long as the student maintains a satisfactory scholastic record.

WNAX AGRICULTURAL SCHOLARSHIP. The WNAX Broadcasting Company annually provides a $300 scholarship to be awarded to a boy from a farm home who has completed his freshman year in the Division of Agriculture. The selection of the recipient is based on outstanding scholarship, promise of leadership, character and financial need.

WMT FARM RADIO SCHOLARSHIP. This scholarship provides $1,000. This sum will be paid to a selected junior for full-time work as assistant to the farm editor of WMT during the three summer months and for part-time service as campus correspondent for WMT during the subsequent academic year. Applicants will be expected to have shown aptitude in farm radio journalism and be interested in such a career.

THE BORDEN AGRICULTURAL SCHOLARSHIP AWARD. This award of $300 will be presented annually to that eligible student in the Division of Agriculture who, upon entering his senior year of study, has achieved the highest average grade of all other similarly eligible students in all preceding college work. Those students will be eligible for the award who have included in their curricula two or more dairy courses.

AGRICULTURAL LIMESTONE SCHOLARSHIP AWARD. The Iowa Agricultural Limestone Association presents annually a cash award of $200 to a first quarter senior enrolled in the curriculum of Agronomy; who is a resident of Iowa, financially needy, of good moral character, and stands in the upper one-fourth of his class scholastically. It was presented for the first time in the Fall of 1950.

FARMERS NATIONAL COMPANY SCHOLARSHIP FUND. The Farmers National Company, Omaha, Nebraska, is making a $500 four-year scholarship award available in alternate years. The first scholarship was awarded in 1947. The scholarship will be paid in the amount of $125 per school year. It is available only to scholastically superior male students who have had farm experience and are interested in farm management.

POULTRY INDUSTRY SCHOLARSHIP FUND. This fund of over $2,000 has been established by Poultry Industry members of Iowa to provide scholarships amounting to $225 a year for undergraduate students majoring in Poultry Husbandry. These scholarship awards are made to assist superior, but financially handicapped, students who are interested in preparing themselves to work in some branch of the Poultry Industry.

These scholarships are limited to Iowa boys and girls and the selection of the recipients is based on scholastic effort, character, financial need and promise of leadership.

JOHN MORRELL & COMPANY AWARD. This is an annual award of $25 to each of the four members of the Intercollegiate Meat Judging Team made by the John Morrell Packing Company of Ottumwa, Iowa. The money is to be used in defraying expenses in attending the intercollegiate meat judging contest at the Chicago International.

AMERICAN YOUTH FOUNDATION AWARDS. The Danforth Foundation, St. Louis, Missouri, awards annually two summer agricultural scholarships; one to a Freshman and one to a Junior. These awards are made only to students who have made a commendable record and who possess leadership possibilities. The Freshman award provides for two weeks of leadership training at the American Youth Foundation Camp, Shelby, Michigan, with all expenses paid. The Junior award, called the Danforth Summer Fellowship, is for four weeks, and is awarded jointly by the Danforth Foundation and the Ralston Purina Company. It provides for all expenses at the camp referred to above and, in addition, two weeks at St. Louis, visiting the Research Laboratories and farm of the Ralston Purina Company.

CHARLES LATHROP PACK PERMANENT FORESTRY PRIZE FUND. This fund of $2,000 has been provided by Charles Lathrop Pack, who was one of the leading conservationists of the country. The annual income from this fund is to be used for prizes in developing more effective writing and speaking among technical forestry students. The topics may deal with forestry or any closely related subject. The competition is open to all forestry students.

GAMMA SIGMA DELTA-ALPHA ZETA SCHOLARSHIP PRIZE. To encourage superior work and to reward the student for conscientious effort during his freshman year, the honor societies of Gamma Sigma Delta and Alpha Zeta are jointly offering a prize to the freshman student having the best scholastic record in the Division of Agriculture.

GEORGE GUND ANIMAL HUSBANDRY SCHOLARSHIP. This scholarship of $300 is given annually by Mr. George Gund of the Gund Realty Company of Cleveland, Ohio. It is awarded by the animal husbandry staff to the senior student majoring in animal husbandry, who as a junior made the best record in scholarship, character, and initiative.

RUSSELL I. KLOPP MEMORIAL. Dr. Henry I. Klopp has established a fund in memory of his son, Russell I. Klopp, who lost his life shortly after graduation in 1923. The income of this fund, approximately $20, is offered as a prize each year to the senior student in horticulture who has made the highest average standing during his junior and senior years.

PAUL P. STEWART MEMORIAL SCHOLARSHIP. The proceeds from a fund established in honor of the late Paul P. Stewart, prominant breeder of Holstein cattle in Iowa, will be available for this scholarship. The award will be made to a boy from a farm home who has completed his freshman year. The selection of the recipient will be based on interest in dairy cattle (primarily the Holstein breed), scholarship, character, leadership and financial need.

GEORGE H. WALKER PRIZE. This prize consists of the annual income of the permanent fund of $1,000 donated by George H. Walker of Boston, Massachusetts, one of the founders of the Walker Gordon Milk Company. It is

awarded annually to a senior in dairy industry or a senior in dairy husbandry who has made outstanding progress in the study of milk.

ZIMMERMAN MEMORIAL PRIZE. Mr. W. F. Zimmerman of Chicago has established a permanent fund in memory of his son, Herbert, an exemplary young man who lost his life through an accident while enrolled as a student in the Department of Horticulture. The income of this fund, now not less than $20, is offered as a prize each year to a superior junior horticultural student. The award is made on the basis of ability, scholarly attainment, character, and interest in affairs which are worthy of the attention of students who are preparing themselves to do the best possible work as horticulturists and as citizens.

LOAN FUNDS. Students majoring in Animal Husbandry may obtain assistance from the Pullman Loan Fund. Other students are eligible for assistance from loan funds administered by the Director of Student Loans.

PUBLICATIONS: The students in the Division of Agriculture, under the general supervision and direction of the Department of Technical Journalism, publish a monthly journal known as *The Agriculturist*. The publication has taken high rank in its class and affords students an opportunity to get practical training and experience in agricultural writing. In addition, much of the meritorius work of advanced students in agricultural journalism is used by the agricultural press and by daily and weekly papers. *The Ames Forester* is an annual published by the Forestry Club. The students, with the assistance of the alumni working in the field, have made this an attractive publication of a technical character. *Horizons* is a quarterly magazine published by the students of the Department of Landscape Architecture.

Curricula in Agriculture

The entire program of instruction, research and extension in Agriculture at the Iowa State College is for one purpose—to serve the people of Iowa, especially the farm people.

The course work offered in agriculture at the Iowa State College is based upon the latest findings made available through research and experimental work. Because the teaching program is continually kept up to date, the demand for men and women trained in agriculture at Iowa State College is great. There is every reason to expect that in the years ahead the need for well-trained people in the agricultural industries will continue or even become greater. Farming has become a very complex enterprise and the value of a thorough understanding of the basic scientific concepts related to agriculture has been demonstrated again and again.

At Iowa State College an opportunity is given for the student to specialize in some phase of agriculture such as the four year programs in Agricultural Business and Rural Administration, Agricultural Education, Agricultural Journalism, Agricultural Engineering, Agronomy, Animal Husbandry, Dairy Husbandry, Dairy Industry, Farm Operation, Forestry, Horticulture, Industrial Education, Landscape Architecture, and Poultry Husbandry. In addition special, non-degree curricula are offered in Dairy Plant Operation, Farm Operation and for Herdsmen. In each instance a general background in agriculture is emphasized so that, regardless of the occupation the student eventually enters, he will have a broad understanding of the basic elements of agriculture. The main purpose of each of these curricula is to prepare men and women to better serve the needs of agriculture.

Besides providing specialized and general backgrounds in agriculture, each of the curricula includes courses in the basic physical, biological, and social

sciences, with sufficient English, literature, and history to broaden the student culturally and to make him proficient in serving his fellow men. The fact that many of our graduates have made outstanding records in farming, in the agricultural industries and in other work demonstrates the value of such training.

One of the main occupational objectives of collegiate instruction in agriculture is to prepare young people for general farming and rural living. Other specific objectives include educating people to become managers of large-scale farm enterprises; to become teachers in high schools and colleges; to become research workers in state and federal agencies, privately endowed institutions and in industry; to become extension specialists, county extension directors or extension assistants in youth work; to enter commercial work in the agricultural industries; to become consultants on agricultural problems; and finally to provide agricultural background for students entering other professional or commercial fields. A recent study showed that, for the ten-year period investigated, 91 percent of all students graduated from agricultural curricula were employed in the type of work for which they prepared themselves in college.

The curricula provided in agriculture afford the student an opportunity to study that phase of agriculture in which he is most interested and for which he is best suited. Federal funds and annual appropriations of state funds for research, extension, and instruction in agriculture and related sciences enable the staff to make effective use of the experimental fields, barns, processing plants, gardens, and orchards as laboratories for practical investigations, as well as for instructional purposes.

Preparation for Graduate Study while in an Undergraduate Curriculum

The student who intends to get an advanced degree in Agriculture should include in his plan of study fundamental courses in mathematics, languages and the physical and biological sciences. An understanding of these courses is usually indispensable to admission into graduate study and to the research required of graduate students. A student who intends to work toward the Master of Science or Doctor of Philosophy Degree in Agriculture should take, as soon as conveniently possible, basic courses in mathematics, chemistry, physics, botany and zoology. The mathematics should include algebra, trigonometry and analytical geometry. The chemistry should include both inorganic and organic chemistry. In addition to these strongly recommended courses the student will find bacteriology, genetics and statistics valuable. Graduate students are usually required to have a reading knowledge of French or German before the Master's Degree can be awarded; they must be able to read both languages before the Doctor's Degree can be conferred. The student should consider taking courses in one of these languages during the senior year.

The above are minimum recommended courses. Other courses more specifically suited to the student's special interest may be added when his goal in graduate work becomes clear.

Curriculum in Agricultural Business and Rural Administration

Administered jointly by the Division of Agriculture and the Division of Science in the Department of Economics and Sociology.

Leading to the degree of Bachelor of Science.

Six months of practical work approved by the department is required before graduation.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Crop Production Agron. 111	3	Crop Production Agron. 112	4	Livestock Problems A.H. 112	3
Livestock problems A.H. 111	3	Soils & Soil Mgt. Agron. 154	4	General Chemistry Chem. 102	4
Prin. of Composition Engl. 101	3	General Chemistry Chem. 101	4	Prin. of Composition Engl. 103	3
Elements of Farm Mgt. Ec. 130	4	Prin. of Composition Engl. 102	3	General Biology Zool. 104	3
General Botany Bot. 101	3	Military Science 112	1	Electives	3
Military Science 111	1			Military Science 113	1
	17		16		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 101, 102, 103; Libr. 106A (Fall); Ec. 110 (Spring); Orientation, Ag 101; Ag. 104.

Sophomore Year

Forage Crops Agron. 234	4	Livestock Feed. & Mgt. A.H. 216	3	Prin. of Economics Ec. 233	3
Prin. of Economics Ec. 231	3	**Organic Chemistry Chem. 264	5	Hist. of American Ag. Hist. 324	3
Gen. Math. & Statistics Math. 241	4	Prin. of Economics Ec. 232	3	Gen. Math. & Statistics Math. 243	4
*Introd. to Sociology Soc. 234	3	Gen. Math. & Statistics Math. 242	4	Beginning Tech. Journ. T.Jl., 225	3
Electives	2	Military Science	1	Electives	3
Military Science	1			Military Science	1
	17		16		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Junior and Senior Years

1. A minimum of one hundred credits is required to complete the junior and senior years. Most of the courses will be of senior college rank. The student has the opportunity to select courses which will provide training for the field of his major interest.

2. During the last quarter of his sophomore year the student will work out his complete senior college program in conference with his counselor. This program must meet the approval of the Dean of Agriculture.

3. A minimum of thirty credits shall be chosen from courses in Agricultural Economics and Rural Sociology and related subjects, fifteen credits in General Economics and Sociology, fifteen credits of other social science subjects such as history, government, psychology, political science and forty credits of free electives of which at least nine credits must be in technical agriculture.
   The curriculum in Economics and Sociology provides an opportunity for students to specialize in (A) Agricultural Business, which provides training for work in farm management, farm credit and appraisal, marketing and distribution of farm products and farm supplies, (B) Rural Administration, which prepares a student for positions in agricultural administration, public relations and extension work in the field of agriculture, (C) Pre-graduate study in preparation for advanced training in agricultural economics or rural sociology.
   Students in this curriculum will ordinarily take in their junior and senior years such courses as Ec. 304, 330, 331, 334, 335, 355, 365, 384, 404, 405, 435, 436, 440, 447, 548, 549; Soc. 364, 386, 464, 487; Gen. 300; Psych. 204; Sp. 311; Phys. 204, and Bact. 304. The courses listed on page 93 are also suggested as electives for students who wish to prepare for work in the following fields:

*Ag. Business majors may substitute Soc. 200 for Soc. 234.
**Students majoring in Sociology may substitute elective courses for Chem. 264.

A. Agricultural Business

1. Farm Management and Farm Credit: Agron. 354, 414, 464; Ag. Engr. 306, 334, 489; V.Hyg. 427; V.Anat. 217; V.Phys. 364; A.H. 254; Zool. 374.

2. Marketing, Processing and Distributive Industries: Ec. 305, 366, 480, or Psych. 464 and such marketing courses as Ec. 402 and 403.
Students wishing to specialize in commodity marketing should elect courses in the various commodity departments.
Those wishing to enter cooperative businesses should elect, in addition to the above courses: Ec. 336; Soc. 364, 464, 487.

B. Rural Administration: Soc. 364, 464, 486, 487; Govt. 315, 476, 485, 487, 490, 491; V.Ed. 304, 305, 466, 467, 537, 550, plus courses in agronomy and animal husbandry as in A (1) above. Students particularly interested in extension work will also want to review the statement on Training for Extension on page 110.

C. Pre-Graduate Study: As soon as a student knows that he is interested in graduate study he should consult his counselor. Appropriate changes will then be made in his program. See list of courses on page 92.

Curriculum in Agricultural Education

Administered by the Department of Vocational Education.

Leading to the degree of Bachelor of Science.

Six months of practical work approved by the department is required before graduation. Two calendar years of farm experience after the age of fourteen are required of those who want to qualify to teach vocational agriculture.

For description of courses in agricultural education, see page 323

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Livestock Problems A.H. 111	3	Crop Production and Management Agron. 114	4	Livestock Problems A.H. 112	3
Prin. of Composition Engl. 101	3	General Botany Bot. 101	3	Prin. of Composition Engl. 103	3
General Horticulture Hort. 114	3	Elements of Dairying D.I. 114	4	[1]Ag. Mathematics Math. 205	4
Drawing for Teachers of Agr., I.Ed. 154	2	Prin. of Composition Engl. 102	3	Gen. Poultry Husbandry P H. 101	3
Animal Biology Zool. 109	4	Military 112	1	Military 113	1
Military 111	1			Electives	3
	16		15		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 101, 102, 103; Library 106A (Fall); Orientation, Ag. 101, Ag. 104; V.Ed. 110 (Spring).

[1]Students desiring to elect a sequence in mathematics should substitute Math. 101 for Math. 205.

Sophomore Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Forage Crops Agron. 234	4	[1]Farm Mechanics A.E. 254	2	[1]Carpentry A.E. 255	2
[1]Breeds of Livestock A.H. 205	4	General Chemistry Chem. 102	4	Soils Agron. 154	4
General Chemistry Chem. 101	4	Prin. of Economics Ec. 232	3	Applied Organic Chemistry, Chem. 257	4
Prin. of Economics Ec. 231	3	Ag. Physics Phys. 204	3	Prin. of Economics Ec. 233	3
Survey of Ag. Education V.Ed. 211	1	Beginning T. Jl. T. Jl. 225	3	General Psychology Psych. 204	3
Military	1	Military	1	Military	1
	17		16		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

[1]Required of students qualifying to teach vocational agriculture; optional for others.

Pre-Graduate Training

Students interested in preparing for graduate training in Vocational Education should consult with the counselor and the head of the department.

Junior and Senior Years

1. The junior and senior years will cover a minimum of one hundred credits, and will be planned to carry forward and expand the field of the student's major study as represented by the option chosen at the end of the sophomore year. A foundational or advanced systematic sequence of science or social studies may be chosen for the student's minor, non-agricultural teaching fields. During the last quarter of the sophomore year or early in the junior year, a complete program will be worked out by the student in conference with the head of the major department, subject to the approval of the Dean of Agriculture. Duplicate copies will be filed in the dean's office and in the office of the Registrar.
2. The subjects making up the junior and senior years must ordinarily be of senior college rank.

Special Requirements

1. A list of the courses required of students qualifying to teach vocational agriculture is on file in the Department of Vocational Education. These courses include a minimum of eighteen credits in each of the following fields: agronomy, animal husbandry, agricultural engineering, and economics and sociology. This minimum is exceeded in most cases and is supplemented by courses in dairy industry, forestry, horticulture, and landscape architecture. In addition, supporting subjects from the Division of Science are included in order to develop the major field more adequately and to meet course prerequisites.
2. Professional courses in education and psychology must be taken to qualify for a teacher's certificate. The following courses are required for the Iowa Standard Secondary Certificate: V.Ed. 304, 305, 426; Psych. 204, 334, and 414 or 434; Govt. 315A. Courses in special methods and supervised student teaching are also required. The following courses are recommended to strengthen the professional preparation of prospective teachers: V.Ed. 533, 534, 538 and 550.

Pre-Graduate Training

Students interested in graduate training in agricultural education should consult with the counselor and the head of the department, preferably as early as the beginning of the sophomore year. A modified curriculum will be outlined, subject to the approval of the classifying officer, to meet the individual needs of the student in preparation for graduate study.

Curriculum in Agricultural Engineering

Administered jointly by the Division of Agriculture and the Division of Engineering, see page 115.

Curriculum in Agricultural Journalism

Administered by the Department of Technical Journalism.

Leading to the degree of Bachelor of Science.

Students are required to spend the summer following their sophomore year in practical farm work on an approved farm and to spend the summer following their junior year in practical work with some radio station or farm publication.

Students are expected to maintain an average of not less than B in senior college technical journalism courses in order to continue in this curriculum.

There shall be a total of 15 credits of electives taken in one major line of agriculture.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Livestock Problems A.H. 111	3	General Chemistry Chem. 102	4	Crop Production and Management Agron. 114	4
General Botany Bot. 101	3	Elements of Dairying D.I. 114	4	Livestock Problems A.H. 112	3
General Chemistry Chem. 101	4	Prin. of Composition Engl. 102	3	Organic Chemistry Chem. 264B	5
Prin. of Composition Engl. 101	3	Gen. Poul. Husbandry P.H. 101	3	Prin. of Composition Engl. 103	3
General Horticulture Hort. 114	3	Introd. to Sociology Soc. 234A	3	Journalistic Vocations T.Jl. 110	2
Military 111	1	Military 112	1	Military 113	1
	17		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Phys Ed. 101, 102, 103; Library 106A (Fall); Ag. 101, Ag. 104.

Sophomore Year

Soils Agron. 154	4	Prin. of Economics Ec. 232	3	Forage Crops Agron 234	3
Prin. of Economics Ec. 231	3	Radio Speech & Production Speech 302	3	General Bacteriology I Bact. 304A	5
Hist. of American Agriculture Hist. 324	3	Ag. Mathematics Math. 205	4	Prin. of Economics Ec. 233	3
Prin. of Broadcasting Speech 301	3	General Psychology Psych. 204	3	Technical Writing T.Jl. 223	4
Technical Writing T.Jl. 221	4	Technical Writing T.Jl. 222	4	Military	1
Military	1	Military	1		
	18		18		16

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Junior Year

Farm Mach. & Power Mgt. A.E. 334	4	Propaganda Analysis Engl. 205	3	American Government Govt. 315A	3
Copy Editing & Typog. T.Jl. 341	2	[1]Psychology of Advertising Psych. 484	3	News Photography T.Jl. 317	3
Technical Advertising T.Jl. 445	3	Copy Editing & Typog. T.Jl. 342	2	Copy Editing & Typog. T.Jl. 343	2
Electives	8	Technical Advertising T.Jl. 446	3	Mgt. of Tech. Journals T.Jl. 451	2
		Electives	6	[2]Rur. Commun. Newspaper T.Jl. 464	3
				Electives	3
	17		17		16

[1]Courses to be omitted by advanced R.O.T.C. students.

[2]Courses recommended as electives in the three fields of specialization listed may be substituted upon approval of the head of the department.

Senior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
International Relations Hist. 568	3	Technical Writing T.Jl. 427	3	Business Law Ec. 365C	3
Technical Writing T.Jl. 426	3	[3]Radio Writing T.Jl. 475	3	Trans-Mississippi West Hist. 535	3
Law of Communications T.Jl. 430	3	Electives	10	[3]Mech. of Print. & Illust. T.Jl. 465	3
Radio News T.Jl. 482	2			Technical Writing T.Jl. 528	3
Electives	6			[3]Broadcasting T.Jl. 576	3
				Electives	1
	17		16		16

[2]Courses recommended as electives in the three fields of specialization listed may be substituted upon approval of the head of the department

[3]Students taking T.Jl. 475 in Winter Quarter may replace T.Jl 576 by an additional 3 credits of electives in the spring; those planning to take T.Jl. 576 in the Spring Quarter may replace T.Jl. 475 by an additional 3 credits of electives in the winter.

Substitutions may be arranged with the approval of the head of the department for certain journalism courses required in the junior and senior years. This yields greater flexibility in adapting the senior college curriculum to the needs of individual students who wish to specialize in such fields as those enumerated below:

Students preparing to enter radio should elect T.Jl. 326, 482, 583, and take both T.Jl. 475 and 576.

The following electives are recommended for students preparing to enter the general field of agricultural writing: T.Jl. 452, 453, Genetics 300, A.H. 205, Econ. 407, 525, 335 or 430, English 256, 354 or 364.

The following electives are recommended for students planning to enter advertising: Economics 384, 468 and 515, T.Jl. 326, 515.

Students enrolled in the Division of Science may choose a major in technical journalism according to provisions explained on page 145.

Curriculum in Agronomy

Leading to the degree of Bachelor of Science.

Six months of practical work meeting the approval of the department is required before graduation.

Freshman Year

Principles of Crop Production Agron. 111	3	Grain Crops Agron. 112	4	Soils Agron. 154	4
Livestock Problems A.H. 111	3	General Chemistry Chem. 101	4	Livestock Problems A.H. 112	3
General Botany Bot. 101	3	Elements of Dairying D.I. 114	4	General Chemistry Chem. 102	4
Prin. of Composition Engl. 101	3	Prin. of Composition Engl. 102	3	Prin. of Composition Engl. 103	3
General Horticulture Hort. 114	3	Military 112	1	Ag. Geology Geol. 375	3
Military 111	1			Military 113	1
	16		16		18

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 101, 102, 103; Library 106A (Fall); Ag. 101; Agron. 100 (Spring); Ag. 104.

Sophomore Year

Forage Crops Agron. 234	4	Crop Seed Agron. 238	3	Soil Fertility Agron. 354	4
Qualitative Analysis Chem. 103	4	General Botany Bot. 102	3	Organic & Quantitative Chem. 256	3
Prin. of Economics Ec. 231	3	Org. Chem. & Quant. Anal. Chem. 255	3	Principles of Econ. Ec. 233	3
General Psychology Psych. 204	3	Prin. of Economics Ec. 232	3	Ag. Physics Phys. 204	3
Speech-Making Sp. 311	3	College Algebra Math. 101	5	Beginning T. Jl. T.Jl. 225	3
Military	1	Military	1	Military	1
	18		18		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Students preparing for graduate work should substitute Math. 102 for Phys. 204 in the Spring Quarter. They may also substitute Chem. 211 and 212 for Chem. 255 and 256.

Junior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Fundamentals of Animal Nutrition A.H 318	3	Livestock Production A.H. 415	3	Soil and Water Conservation, A.E. 306	3
General Bacteriology I Bact. 304A	5	General Genetics Gen. 300	3	Livestock Production A H 416	3
El Plant Physiology Bot. 205	4	Hist of American Agr. Hist. 324	3	General Plant Pathology Bot. 207	4
Electives	5	*Electives	8	*Electives	7
	17		17		17

Senior Year

Seminar Agron. 411	1	Crop Management Agron. 414	3	Soil Management Agron. 454	3
Soil Conservation and Erosion Control Agron. 464	3	Seminar Agron. 451	1	Farm Insects Zool. 374	4
American Government Govt. 315A	3	Cereal & Forage Crop Br. Agron. 524	4	*Electives	10
Introd. to Sociology Soc. 234A	3	Agro -Bacteriology Agron. 485	3		
*Electives	7	*Electives	5		
	17		16		17

**Electives in Various Fields of Interest*

The curriculum in Agronomy offers a total of 42 elective credits in the junior and senior years. This provides opportunity for students either (1) to obtain a broad training in agronomy and related fields of interest, (2) to specialize in one of several phases of agronomy, or (3) to prepare for graduate studies by electing sequences of courses in allied science.

Electives are to be chosen in conference with the senior college counselor and the head of the department. Ten of the elective credits should be in agronomy.

Broad Training

Students who are interested in positions which will require a broad knowledge of agriculture and want to take considerable work in agronomy and closely related fields of interest will elect various courses and course sequences to meet their particular needs. The electives will be taken not only in agronomy and closely-related fields of agriculture, but also in the social sciences and humanities.

Specialized Training

The courses listed below are suggested as electives for students who wish specialized training in these several fields of interest.

Commercial Seed Production or Seed Technology

Agron. (Bot) 338; Agron. (Bot.) 438, Agron 514, Agron 534, Agron. (Bot) 538; Bot. 206, 554, 556, other electives, 16 cr

Soil Conservation Planning

Agron. 473, 534, 565, 577; Ec. 334, 430; For. 320; other electives, 19 cr.

Soil Survey and Land Appraisal

Agron. 473, 534, 565, 577; Ec 334, 430, A E 489, For. 320, other electives, 19 cr.

Pre-Graduate Training

Students interested in preparing for graduate studies in any of the three major fields should consult with the head of the department as early in their college work as possible—preferably by the beginning of the sophomore year. A sequence of courses will be outlined, including those listed below; where desirable, certain substitutions will be arranged with the approval of the classifving officer and the substitution committee.

Farm Crops

Bot. 204, 206; Chem. 331, 332; Gen. 305, 500; Math. 102, 103; M.L. 231, 232, 233; other electives, 9 cr.

Soils

Chem. 321, 322 or 331, 332; Geol. 355; Math. 211, 212; Phys. 211, 212, 213; other electives, 13 cr.

Agricultural Climatology

Math. 211, 212; Stat. 301; Phys. 211, 212, 324, 325 and 334; other electives, 15 cr.

Curriculum in Animal Husbandry

Leading to the degree of Bachelor of Science.

Six months of practical work under the direction of the department is required before graduation.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Crop Production Agron. 111	3	Farm Mechanics A.E. 254	2	Livestock Problems A.H. 112	3
Livestock Problems A.H. 111	3	Crop Production Agron. 112	4	General Chemistry Chem. 102	4
Livestock Management A.H. 125	2	Livestock Problems A.H. 115	2	Elements of Dairying D.I. 114	4
General Botany Bot. 101	3	General Chemistry Chem. 101	4	Prin. of Composition Engl. 103	3
Prin. of Composition Engl. 101	3	Prin. of Composition Engl. 102	3	Military 113	1
Military 111	1	Military 112	1		
	15		16		15

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 101, 102, 103; Library 106A (Fall); Tech. Lect., A.H. 110 (Spring); Orientation, Ag. 101; Ag. 104.

Sophomore Year

Breeds of Livestock A.H. 211	3	Breeds of Livestock A.H. 212	3	Forage Crops Agron. 234	3
Qualitative Analysis Chem. 103	4	Organic and Quantitative Chem. 255	3	Farm Meats A.H. 270	3
Prin. of Economics Ec. 231	3	Prin. of Economics Ec. 232	3	Organic & Quantitative Chem. 256	3
Anat. Domestic Animals Vet. Anat. 217	3	Ag. Mathematics Math. 205	4	Prin. of Economics Ec. 233	3
Animal Biology Zool. 109	4	Speech-Making Speech 311	3	Ag. Physics Phys. 204	3
Military	1	Military	1	Military	1
	18		17		16

In addition to the courses listed above, each student will be required to include in his schedule. Phys.Ed. 201, 202, 203.

Junior Year

Soils Agron. 154	4	Soil Fertility Agron. 354	4	Farm Mach. & Power Mgt. A.E. 334	4
Livestock Judging A.H. 305	2	Applied Animal Nutrition A.H. 319	3	Animal Breeding A.H. 350	3
Animal Nutrition A.H. 318	3	General Bacteriology Bact. 304A	5	Farm Mgt. and Organ. Ec. 330	4
Physiol. of Dom. Animals Vet.Phys. 364	3	General Genetics Gen. 300	3	Introd. to Sociology Soc. 234A	3
Embryology Zool. 334	3	Electives	3	Electives	3
Electives	3				
	18		18		17

Senior Year

Soil Management Agron. 454	3	Farm Bldgs. & Equip. A.E. 489 or Farm Insects Zool. 374	3 or 4	Swine Prod. & Mktg. A.H. 425	3
Mkt. Cl. & Gr. of Livestock, A.H. 409	2	Milk Prod. & Herd Mgt. A.H. 434	2	Beef Cattle Prod. & Mktg. A.H. 427	3
Sheep Prod. & Mktg. A.H. 429	2	Herd-Book Study A.H. 460	3	Hist. of American Agric. Hist. 324	3
American Government Govt. 315A	3	Electives	8 or 9	Electives	8
Electives	7				
	17		17		17

The following courses are suggested as electives for students majoring in Animal Husbandry or Dairy Husbandry who wish to prepare for these special fields:

Livestock and Dairy Farming and Farm Management, Animal Husbandry 403, 431; Poultry Husbandry 101; Economics 335, 365C, 435; Veterinary Hygiene 427; Agronomy 464; English 404.

Extension Work. Agronomy 464; Technical Journalism 225; Vocational Education 466, 467; Sociology 386, 487; Psychology 204; Speech 312; English 404. (See statement on Training for Extension, Page 110.)

Commercial Creamery, Meat Packing, Feed Manufacture, etc. Economics 335, 365C; Animal Husbandry 403, 475; Chemistry 474, Bacteriology 535; English 404.

Graduate Work. Students interested in graduate training in Animal Husbandry or Dairy Husbandry should consult with the head of the department as early in their college work as possible, preferably in the first year. Electives and substitutions for certain required courses will be arranged to meet the needs of the individual student in preparation for graduate study.

Curriculum in Dairy Husbandry

Administered by the Department of Animal Husbandry.

Leading to the degree of Bachelor of Science.

Six months of practical work under the direction of the department is required before graduation.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Crop Production Agron. 111	3	Crop Production Agron. 112	4	Farm Mechanics A.E. 254	2
Livestock Problems A.H. 111	3	General Chemistry Chem. 101	4	Livestock Problems A.H. 112	3
Livestock Management A.H. 125	2	Prin. of Composition Engl. 102	3	General Chemistry Chem. 102	4
General Botany Bot. 101	3	General Horticulture Hort. 114	3	Elements of Dairying D.I. 114	4
Prin. of Composition Engl. 101	3	Military 112	1	Prin. of Composition Engl. 103	3
Military 111	1			Military 113	1
	15		15		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 101, 102, 103; Library 106A (Fall); Tech. Lect., A.H. 110 (Spring); Orientation, Ag. 101; Ag. 104.

Sophomore Year

Breeds of Livestock A.H. 211	3	Breeds of Livestock A.H. 212	3	Forage Crops Agron. 234	3
Qualitative Analysis Chem. 103	4	Organic & Quantitative Chem. 255	3	Farm Meats A.H. 270	3
Prin. of Economics Ec. 231	3	Prin. of Economics Ec. 232	3	Organic & Quantitative Chem. 256	3
Anat. Domestic Animals Vet. Anat. 217	3	Ag. Mathematics Math. 205	4	Prin of Economics Ec. 233	3
Animal Biology Zool. 109	4	Speech-Making Speech 311	3	Ag. Physics Phys. 204	3
Military	1	Military	1	Military	1
	18		17		16

In addition to the courses listed above, each student will be required to include in his schedule. Phys.Ed. 201, 202, 203.

Junior Year

Soils Agron. 154	4	Animal Nutrition A.H. 318	3	Soil Fertility Agron. 354	4
General Bacteriology I Bact. 304A	5	Dairy Bacteriology D.I. 350	5	Applied Animal Nutrition A.H. 319	3
Physiol. of Dom. Animals Vet.Phys. 364	3	General Genetics Gen. 300	3	Adv. Study Dairy Breeds A.H. 335	2
Embryology Zool. 334	3	Introd. to Sociology Soc. 234A	3	Animal Breeding A.H. 350	3
Electives	2	Electives	3	Dairy Cattle Breed Studies A.H. 360	2
				Electives	3
	17		17		17

Senior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Soil Management Agron. 454	3	Dairy Farm Problems A.H. 536	3	Market Milk D.I. 305	3
Insemination of Farm Animals, A.H. 431	3	Dy. H. Seminar A.H. 539	2	Hist. of American Agric. Hist. 324	3
Milk Production A.H. 434	2	American Government Govt. 315A	3	Electives	11
Milk Secretion A.H. 535	3	Electives	9		
Electives	6				
	17		17		17

Curriculum in Dairy Industry

Leading to the degree of Bachelor of Science.

Freshman Year

Dairy Mechanics A.E. 157	2	General Chemistry Chem. 102	4	Soils and Soil Mgt. Agron. 154	4
Livestock Problems A.H. 104	2	Milk Test. & Inspect. D.I. 116	5	Qualitative Analysis Chem. 103	4
General Chemistry Chem. 101	4	Prin of Composition Engl. 102	3	Prin. of Composition Engl. 103	3
Elements of Dairying D.I. 114	4	General Psychology Psych 204	3	College Algebra Math. 101	5
Prin. of Composition Engl. 101	3	Military 112	1	Military 113	1
Military 111	1				
	16		16		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 101, 102, 103; Library 106A (Fall), Orientation, Ag. 101, Ag. 104, Tech Lect., D.I. 110 (Spring).

Sophomore Year

Quantitative Analysis Chem. 211	4	Organic Chemistry Chem 334	4	Organic Chemistry Chem 335	4
Prin. of Economics Ec. 231	3	Judging Dairy Prod. D.I. 207	1	Cheese Manufacture D.I. 215	5
Plane Trigonometry Math. 102A	5	Prin. of Economics Ec. 232	3	Prin. of Economics Ec. 233	3
American Government Govt. 315A	3	Propaganda Analysis Engl. 205	3	Hist. of Am. Agr. Hist. 324	3
Military	1	Speech-Making Speech 311	3	Military	1
		Beginning T.Jl. T Jl 225	3		
		Military	1		
	16		18		16

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Junior Year

General Bacteriology Bact. 304A	5	Adv Dairy Chem. Chem. 348	5	Manufacture of Butter D I. 304	5
Dairy Chemistry Chem. 347	5	Judging Dairy Products D.I. 308	1	Market Milk D.I. 305	5
Accounting I Ec. 384C	4	Dairy Bacteriology D.I. 350	5	Mfg. of Ice Cream D.I. 306	5
Electives	3	Electives	6	Tech. Advertising T.Jl. 325	2
	17		17		17

Senior Year

Dairy Cattle Feed. & Mgt. A.H. 337	3	Dairy Plant Equipment D I 492	4	Forage Crops Agron. 234	3
Condensed Milk Prod. D.I. 404	4	Mgt. of Dairy Plants D.I. 504	5	Dairy Plant Equipment D.I. 493	4
Seminar D.I. 405	2	Electives	8	Milk Inspection D.I. 558 or Bact. of Butter & Cheese, D.I. 559	4 or 5
Dairy Plant Equipment D.I. 491	4			Business Law I Ec. 365C	3
Electives	3			Electives	1 or 0
	16		17		15

Major in Dairy Industry and Economics

Students desiring to major in this field will be required to take a minimum of 12 credits selected from the following courses in Economics: 304, 335, 368, 385, 407; Agron. 234 may be omitted. Students classify in Math. 242 instead of Math. 102A, and in Math. 243.

Major in Dairy Industry and Chemistry

Students who wish to major in this field preparing themselves for research work in dairy industry will be required to include the following courses: M.L. 411, 412, 413, or M.L. 441, 442, 443; Chem. 321, 322, 323, 331, 332, 333, 474; Math. 103, 211, 212, 213; Phys. 213; D.I. 559. The following courses may be omitted: Chem. 264B; A.E. 157; Agron. 234; Ec. 231, 232, 233, 384; A.H. 337. Inasmuch as the sequences of chemistry courses plus the hours required will not permit the completion of this joint major in four years, it is desirable to complete a year's work (45 quarter credits) at some approved college before entering, or to take an extra year at this institution. If the former, 9 quarter credits each in English and modern language and 12 quarter credits in general chemistry should be included.

Curriculum in Farm Operation

Administered by the Division of Agriculture

A. The Two-Year Program.

Leading to a certificate showing completion of the program.

This program is designed for students of agriculture who have decided to engage in general farming and who find it impracticable to remain in college longer than one or two years. The course of study in this program is outlined below. However, considerable deviation from the outlined program will be permitted in order to serve better the vocational and cultural needs and interests of individual students. Such adjustments will be worked out by the student and his counselor.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Farm Mechanics A.E. 254	2	Elements of Farm Mgt. Ec. 130	4	Soils Agron. 154	4
Crop Prod. and Mgt. Agron. 114	4	Gen. Chemistry Chem. 101	4	Livestock Problems A.H. 112	3
Livestock Problems A.H. 111	3	Prin. of Composition Engl. 102	3	[1]Prin. of Composition Engl. 103 or Speech Improvement Speech 307	3
General Botany Bot. 101	3	Electives	3		
Prin. of Composition Engl. 101	3	Military 112	1	Animal Biology Zool. 109	4
Military 111	1			Electives	2
				Military 113	1
	16		15		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys Ed. 101, 102, 103, Library 106A (Fall); Orientation, Ag. 101, 104. The requirements of Ag. 104 should be met prior to the junior year

Suggested Electives: D.I. 114, For. 120, Hort. 114, P.H. 101.

Sophomore Year

Soil & Water Conservation A E 306	3	[2]Livestock Feed & Mgt. A.H. 216	3	Forage Crops Agron. 234	4
Ag Mathematics Math. 205	4	Basic Genetics Gen. 200	3	Prin. of Breeding A.H. 254 or Prin. of Crop Breeding Agron. 324	3 or 4
Rural Inst. & Organization, Soc. 200	4	Electives	9		
Electives	5	Military	1	Ag. Physics Phys. 204	3
Military	1			Electives	3 or 4
				Military	1
	17		16		15

In addition to the courses listed above, each student will be required to include in his schedule: Phys Ed. 201, 202, 203.

[1]English 103 required for the Bachelor of Science Degree.

[2]Students who plan to take the four-year course should omit A H. 216 and take A.H. 318 after completing the chemistry prerequisites, and should substitute Gen. 300 for Gen. 200.

B. The Four-Year Curriculum in Farm Operation.

Leading to the degree of Bachelor of Science.

Freshman and Sophomore Years

The first two years of the four-year curriculum are identical to the two-year program in Farm Operation. Students who have elected a modified two-year program and who later wish to transfer to the four-year curriculum may do so with the approval of the Dean of Agriculture.

Junior and Senior Years

The junior and senior years will cover a minimum of 99 credits and will be planned to aid the student in achieving his goals in the field of agriculture. During the last quarter of the sophomore year, a program covering the work of the junior and senior years will be outlined by each student in conference with his counselor. These individual programs will be subject to the approval of the Dean of Agriculture.

In order that the graduates of this curriculum may have a well-rounded general, scientific and technical education the course of study for the last two years must include the following: a minimum of 28 credits in the fields of biological and physical sciences (including at least one course in organic chemistry), 24 credits in social sciences, and 24 credits in technical agriculture. The remaining 23 are elective. A minimum of 195 credits is required for graduation.

Curriculum in Forestry

Leading to the degree of Bachelor of Science upon satisfactory completion of four years of work; and degree of Bachelor of Science with major in conservation, forest utilization and marketing, range management, wildlife management, or farm forestry on completion of a fifth year of work as outlined in the five-year curriculum.

Forestry students are required to complete three months of practical forestry work before graduation in addition to the summer camp.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
General Botany Bot. 101	3	General Botany Bot. 102	3	Systematic Botany Bot. 206	4
Prin. of Composition Engl. 101	3	Prin. of Composition Engl 102	3	Prin. of Composition Engl. 103	3
General Forestry For. 101	3	General Forestry For. 102	3	General Forestry For. 103A or B	2 or 3
College Algebra Math. 101	5	Plane Trigonometry Math. 102	5	Anal. Geom. & Statis. Math. 143	3
Military 111	1	Animal Biology Zool. 106	3	Animal Biology Zool. 107	3
		Military 112	1	Military 113	1
	15		18		16 or 17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 101, 102, 103; Library 106A (Fall); Seminar, For. 110 (Spring); Orientation, Ag. 101; Ag. 104 (three months of which are to be Forestry Summer Camp)

Summer Camp

The following courses of study are carried on in the summer camp for forestry students. The camp curriculum occupies ten weeks during the summer between the freshman and sophomore years. Summer camp is prerequisite for entrance to junior year. Silviculture, For. 214, Cr. 3; Wood Utilization, For. 234, Cr. 3; National Forest Operations, For. 250, Cr. 5, Forest Mensuration, For. 244, Cr. 4.

Sophomore Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
General Bacteriology Bact. 200	3	Dendrology Bot. 257	3	Soils Agron. 154	4
Dendrology Bot. 256	4	General Chemistry Chem. 102	4	Plant Physiology Bot. 205	4
General Chemistry Chem. 101	4	Lumber Manufacture For. 225	3	Applied Organic Chem. Chem. 257	4
Logging For. 224	3	Forest Mensuration For. 241	4	Forest Planting For. 206	4
Forest Insects Zool. 377	3	Ag. Physics Phys. 204	3	Forest Mensuration For. 242	3
Military	1	Military	1	Military	1
	18		18		20

In addition to the courses listed above, each student will be required to include in his schedule Phys.Ed. 201, 202, 203; and For. 211, 212, 213, Seminar.

Junior Year

Students expecting to complete one of the five year majors should consult with their respective counselors before the senior year and prepare an outline program of subjects for completion in the five-year group selected. This is necessary in order to arrange for a proper sequence of subjects in the major fields of work.

Gen. Plant Ecol. Bot. 424	3	Forest Soils Agron. 357	3	Surveying C.E. 313	3
Elem. Surveying C.E. 310	4	Survey & Map Mkg. C.E. 312	4	Silviculture For. 303	3
Prin. of Econ Ec. 261	3	Silviculture For. 302	3	Forest Protection For. 390	3
Silviculture For. 301	3	Wood Technology For. 388	4	[1]American Government Govt. 315A	3
Ag. Geology Geol. 375	3	Beginning T.Jl. T.Jl. 225	3	*Electives	6
	16		17		18

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, For. 311, 312, 313.

[1]May be omitted by students appointed to ROTC or NROTC.

Junior Summer Camp

Six weeks camp for students completing the junior year. Optional for students completing the junior year. A full camp schedule is made up of a total of 9 credits chosen from the following: Advanced Forest Industries, For. 530, Cr. 3 to 9; Advanced Forest Admin., For. 590, Cr. 3 to 9; Advanced Range Admin., For. 594, Cr. 3 to 9.

Senior Year

Forest Photogrammerty For 445	5	Forest Pathology Bot. 416	4	Forest Policy & Admin. For. 392	4
Forest Finance For 490	5	General For. Economics For. 470	3	Forest Management For. 498	3
For. Range Mgt. For. 491	3	Forest Products For. 487	5	Speech-Making Speech 311	3
*Electives	5 or 6	Forest Management For. 497	3	*Electives	6 or 7
		*Electives	3		
	18 or 19		18		16 or 17

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, For., 411, 412, 413.

**Specialized Training*

Students in the four-year curriculum who wish to develop their work toward specialized fields are advised to select electives indicated for the respective groups listed below:

Wildlife Management
Zool. 541, 542, 544, 561, 562, 567.

Forest Grazing Management
A H. 111, 212, 318, 415. Bot. 456, 566, 595. For 492, 493, 594

Timber Industries
Chem. 259; Ec 305, 365C, 384D, Engl. 404; For. 385, 438, 587, 588, Gen.E. 351, 404, 407.

Forest Management
Ec. 334, 510; Engl. 404, For 443, 502, 507.

Conservation
A.E. 306; Agron 464, Ec. 334, 510, For. 321, 507

Farm Forestry
For. 321, 507; Psych. 204, Soc. 234, 386, V.Ed 466, 467

General Forestry
Ec 365C, 384D: Engl 205, 404, For. 502, 507; Gen 300, Psych 204, Soc. 234.

Fifth Year Majors

Students expecting to complete any one of the fifth year groups should consult with their counselors during or before the junior year at which time the subjects to be taken will be outlined for the individual student for the senior and fifth years. This will make possible a proper sequence of subjects and provide for the courses of instruction required for the particular major group of his selection. Major sequences are those leading to the degree of Bachelor of Science with majors in one of the following: forestry and conservation, forest utilization, forestry and range management, forestry and wildlife management, or farm forestry.

Curriculum in Horticulture

Leading to the degree of Bachelor of Science.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Crop Production Agron. 111	3	General Botany Bot. 102	3	Farm Mechanics or Farm Carpentry A.E. 254 or 255	2
General Botany Bot. 101	3	General Chemistry Chem. 102	4	Systematic Botany Bot. 206	4
General Chemistry Chem. 101	4	Prin. of Composition Engl. 102	3	Qualitative Analysis Chem. 103	4
Prin. of Composition Engl. 101	3	Greenhouse Methods Hort. 154	3	Prin. of Composition Engl. 103	3
General Horticulture Hort. 114	3	Ag. Mathematics Math. 205	4	Vegetable Crops Hort. 164B	3
Military 111	1	Military 112	1	Military 113	1
	17		18		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 101, 102, 103, Library 106A (Fall); Hort. 110 (Spring); Orientation, Ag 101, Ag. 104.

Sophomore Year

Soils Agron. 154	4	Soil Fertility Agron. 354	4	Principles of Economics Ec. 233	3
Elem. Plant Physiology Bot. 205	4	Organic & Quantitative Chem. 256	3	Grapes & Small Fruits Hort. 224	3
Organic & Quantitative Chem. 255	3	Prin. of Economics Ec 232	3	Garden Flowers Hort. 244	3
Principles of Economics Ec. 231	3	Plant Propagation Hort. 214	3	Speech-Making Sp. 311	3
Ag. Physics Phys. 204	3	Rural Landscape Design L.A. 208	3	Elementary Entomology Zool. 274	4
Military	1	Military	1	Military	1
	18		17		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Junior Year

At the beginning of the junior year, the student must choose a major in pomology, floriculture, nursery management, or vegetable crops.

General Genetics Gen. 300	3	General Bacteriology I Bact. 304A	5	Plant Pathology Bot. 207	4
Elem. Laboratory Gen. 305	1	Commercial Veg. Crops Hort. 366	3	Orcharding Hort. 422	3
Hist. of American Agr. Hist. 324	3	Plant Materials L A 231	3	Plant Materials L.A. 232	3
Orcharding Hort. 421	3	Electives	6	Insects Affecting Hort. Zool. 375	5
Commercial Floriculture Hort. 546	3			Electives	3
Electives	4				
	17		17		18

Senior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Seminar Hort. 401	1	Seminar Hort. 402	1	American Government Govt. 315A	3
Systematic Pomology Hort. 524	3	Systematic Floriculture Hort. 544	3	Seminar Hort. 403	1
Systematic Olericulture Hort. 565	3	Electives	12	Electives	12
Elective in English	3				
Electives	7				
	17		16		16

Specialized Training

The curriculum in Horticulture provides opportunities for specialized training in one or two of several phases of Horticulture. Within the junior and senior years, the following courses are required or suggested as electives.

Floriculture
Required: Hort. 344, 547.
Suggested electives: Arch. 114; Psych. 204, 484, 485.

Nursery Management
Required: For. 206; Hort. 316; L.A. 305, 333
Suggested electives: L A. 111, 112, 113.

Pomology
Required: Hort. 414, 424.
Suggested electives: Ec. 335, 549.

Vegetable Crops
Required: Hort. 414, 564.
Suggested electives: Ec. 335, 549.

Pre-Graduate Training

The following courses are recommended for students interested in preparing for graduate study: Math. 101, 102, 103, 211, 212; Chem. 321, 322; Bot. 554, 556; M.L. 231, 232, 233.

The above courses may be taken as electives; or they may be substituted for some required courses in the Horticulture curriculum, with the approval of the head of the department, the classifying officer and the substitution committee.

Curriculum in Industrial Education

Administered by the Department of Vocational Education.

Leading to the degree of Bachelor of Science.

Provides preparation for teachers of industrial arts, or trades and industry, or both.

Freshman Year

Drawing & Projection E.Dr. 131	2	Projective Drawing E.Dr. 132	3	Working Drawing E.Dr. 133	3
Prin. of Composition Engl. 101	3	Prin. of Composition Engl. 102	3	Prin. of Composition Engl. 103	3
Woodfinishing I.Ed. 105	3	Woodwork II I.Ed. 205	3	Woodwork III I.Ed. 258	3
Woodwork I I.Ed. 106	3	Industrial Arts Design I.Ed 250	3	Metal Casting M.E. 202	2
College Algebra Math. 101	5	Plane Trigonometry Math 102A	5	[1]Electives	5
Military 111	1	Military 112	1	Military 113	1
	17		18		17

In addition to the courses listed above, each student will be required to include in his schedule Phys Ed. 101, 102, 103, Library 106A (Fall); Orientation, Ag. 101; V.Ed. 110 (Spring).

Sophomore Year

Freehand Drawing Arch. 114	2	General Chemistry Chem. 101	4	General Chemistry Chem. 102	4
Prin. of Economics Ec. 231	3	Prin. of Economics Ec. 232	3	Sheet Metal Work I.Ed. 255	3
Bench Metalwork I.Ed. 254	3	Ornamental Metalwork I.Ed. 104	3	Introd. to the Teaching of Industrial Arts I.Ed. 150	3
Ag. Physics Phys. 204 or General Physics Phys. 211	3 or 4	Electrical Construction I.Ed. 251	3	Machine Shop M.E. 207	2
General Psychology Psych. 204	3	Machine Shop M.E. 206	2	Military	1
Military	1	Military	1	[1]Electives	3
[1]Electives	2				
	17 or 18		16		16

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

[1]Electives may be chosen from a minor field or additional courses in industrial education.

Junior and Senior Years

1. In the final quarter of the sophomore year, the student will select the area of industrial education in which he wishes to specialize or will decide to continue with a general program of industrial education. He will also select two minor teaching fields which, together with his major field and supporting work, will form the basis for the program of the junior and senior years. This program will cover a minimum of one hundred and one credits. The complete program will be worked out by the student in conference with his senior college counselor, subject to the approval of the head of the department and the dean of the division. Duplicate copies are to be filed in the dean's office.
2. A minimum of forty credits in industrial education shall be required for graduation. In addition, supporting subjects shall be included which are necessary for the proper development of the major field and which give a general cultural background. Areas of industrial education in which the student may specialize are: Mechanical drawing, woodworking, metalworking, and electricity.
3. The two minor fields of work are usually chosen from the areas of agriculture or science but they may be selected from any area offered at the Iowa State College. Each minor field must include a minimum of fifteen credits in order to meet the requirements in Iowa for the Standard Secondary Certificate. Credit well beyond this minimum will ordinarily be required for graduation, however. The exact amount of credit that must be earned in each minor teaching field will vary with the field selected.
4. The subjects making up the program of the junior and senior years must ordinarily be of senior college rank.
5. The following subjects must be included as indicated, unless completed previously:
   (a) Ec. 305 Economics of Industrial Relations. Cr. 3.
   (b) Engl. 205. Propaganda Analysis, Reasoning, and Writing. Cr. 3 or Engl. 404. Business Correspondence. Cr. 2.
   (c) Speech 311. Speech-making. Cr. 3.
   (d) History 211, 212, and 213. European and American Civilization. Cr. 3 each or
   History 334 and 335. Economic History of the United States. Cr. 3 each.
   (e) Soc. 234. Introduction to Sociology. Cr. 3.
   (f) V.Ed. 550. Visual Methods in Education. Cr. 3.
6. A list of the courses required of students qualifying to teach industrial arts or trade and industrial education is on file with the student's counselor and in the Department of Vocational Education. Professional courses in education and psychology must be taken to qualify for a teacher's certificate. The following courses are required for the Iowa Standard Secondary Certificate: V.Ed. 304, 305, 426; Psych. 204, 334, and 414 or 434; Govt. 315A. Courses in special methods and supervised practice teaching are also required.
7. A student will be required to complete at least 12 weeks of practical work in the trades or industry before he graduates with a Bachelor of Science degree in Industrial Education.

Pre-Graduate Training

Students interested in graduate training in industrial education should consult with the counselor and the head of the department, preferably as early as the beginning of the sophomore year. A modified curriculum will be outlined, subject to the approval of the classifying officer, to meet the individual needs of the student in preparation for graduate study.

Curriculum in Landscape Architecture

Leading to the degree of Bachelor of Science.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
General Botany Bot. 101	3	General Chemistry Chem. 101	4	Arch. Drawing Arch. 103	3
Drawing & Projection E.Dr. 131	2	General Botany Bot. 102 or	3	Soils Agron. 154	4
Prin. of Composition Engl. 101	3	General Horticulture* Hort. 114		Prin. of Composition Engl. 103	3
L.A. Drawing L.A. 111	2	Prin. of Composition Engl. 102	3	Garden Flowers Hort. 244	3
College Algebra Math. 101	5	Introd. to L.A., Design L.A. 112	2	Introd. to L.A. Design L.A. 113	3
Military 111	1	Plane Trigonometry Math. 102A	5	Military 113	1
		Military 112	1		
	16		18		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys Ed. 101, 102, 103; Libr. 106A (Fall); Ag. 101, 104.

Sophomore Year

Arch. Design & Sketching Arch. 201	5	Arch. Design & Color Arch. 202	5	Arch. Design & Color Arch. 203	5
Elementary Surveying C.E. 211	5	Top. & Cad. Surveying C.E. 212	3	Route & Higher Survey C.E. 213	4
L.A. History L.A. 201	3	Land. Arch. History L.A. 202	3	Elements & Theory of Land. Design L.A. 213	2
Elements & Theory of Landscape Design L A. 211	2	Elements & Theory of Land Design L.A. 212	2	Plant Materials L.A. 232	3
Military	1	Plant Materials L.A. 231	3	General Psychology Psych. 204	3
		Military	1	Military	1
	16		17		18

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203

Junior Year

History of Arch. Arch. 351 Survey of Art* A.A. 484	3	History of Arch. Arch. 352 Gen. Applied Psych.* Psych. 354	3	Physical Geology Geol. 202	3
American Govt. Govt. 315A	3	Landscape Construction L.A. 302	3	Landscape Construction L.A. 303	3
Landscape Construction L.A. 301	3	Landscape Design L.A. 312	3	Landscape Design L.A. 313	3
Landscape Design L.A. 311	3	Planting Design L.A. 334	3	Planting Design L.A. 335	3
Plant Materials L.A. 333	3	Planning & Zoning Adm. L.A. 402 Accounting I* Ec. 384A	3	Landscape Practice L.A. 341	R
City or Town Planning L.A. 401	3	Electives	3	Rec. & Reg. Planning L.A. 403 Nursery Methods* Hort. 316	3
				Electives	3
	18		18		18

Senior Year

Roads & Pavement C.E. 354 Public Recreation Facilities* L.A. 404	3	Engr. & City Planning C.E. 404 Site Planning* L A. 452	3	Prin. of Economics Ec. 262	3
Landscape Design L.A. 411	4	Prin of Economics Ec. 261	3	Landscape Service* L.A. 305	3*
Adv. Plant Composition and Design* L.A. 436	3*	Landscape Design L.A. 412	4	Landscape Practice L.A. 342	R
Introd. to Sociology Soc. 234A Forest Insects* Zool. 377	3	Speech-Making Sp. 311	3	Landscape Design L.A. 413	4
Electives	6-3*	Electives	3	Beg. Tech. Journalism T.Jl. 225	3
				Electives	6-3*
	16		16		16

*Courses and electives to be taken by those who expect to specialize in the domestic field.

Curriculum in Poultry Husbandry

Leading to the degree of Bachelor of Science.

Six months of practical work, approved by the department, in the branch of the industry of particular interest to the student is required before graduation.

Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Crop Production & Mgt. Agron. 114	4	Soils Agron. 154	4	General Chemistry Chem. 103	4
General Chemistry Chem. 101	4	General Chemistry Chem. 102	4	Prin. of Composition Engl. 103	3
Prin. of Composition Engl. 101	3	Prin. of Composition Engl. 102	3	Adv. Poultry Farm Mgt. P.H. 103	3
General Poultry Husbandry P.H. 101	3	Poultry Farm Mgt. P.H. 102	3	Animal Biology Zool. 109	4
How to Study Psych. 105	1	Military 112	1	Military 113	1
Military 111	1				
	16		15		15

In addition to the courses listed above, each student will be required to include in his schedule Phys.Ed. 101, 102, 103. Lib 106A (Fall), Ag. 101.

Sophomore Year

Applied Organic Chem. and Quant. Anal. Chem. 255	3	Fundamentals of Nutrition A H 318	3	Prin. of Economics Ec. 233	3
Prin. of Economics Ec. 231	3	Applied Organic Chem. and Quant. Analysis Chem. 256	3	Accounting I Ec. 384D	4
General Horticulture Hort. 114	3	Prin. of Economics Ec. 232	3	Physics Phys. 204	3
Mathematics Math. 205	4	Speech-Making Speech 311	3	Public Address Speech 312	3
Anat. Domestic Animals Vet. Anat. 217	3	Military	1	Military	1
Military	1	*Electives	4	*Electives	3
	17		17		17

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Junior Year

Poultry Judging P.H. 301	3	General Genetics Gen. 300	3	General Bacteriology I Bact. 304A	5
Poultry Nutrition P.H. 320	2	Incubation & Hatchery Management P.H. 302	3	Writing of Scientific Papers Engl. 414	3
Physiol. of Domes. Animals Vet. Phys. 364	3	Poultry Show Org. & Adm. P.H. 303	3	*Electives	9
Embryology Zool. 334	3	Physiol. of Domes. Fowls Vet. Phys. 366	3		
*Electives	6	*Electives	5		
	17		17		17

Senior Year

Mktg. & Processing Poultry Products P.H. 401	4	Business Correspondence Engl. 404	2	Poultry Breeding P.H. 402	3
Poultry Seminar P.H. 501	1	American Government Govt. 315A	3	Poultry Seminar P.H. 503	1
*Electives	12	Poultry Seminar P.H. 502	1	Adv. Poultry Nutrition P.H. 504	4
		*Electives	11	Poultry Sanitation Vet. Hyg. 428	2
				*Electives	7
	17		17		17

*Specialized Training.

The curriculum in Poultry Husbandry provides training in four fields of specialization. The required courses and the approved elective courses for each field are listed below.

Commercial Poultry Farm and Hatchery Operations.

Required: Ag. 104.

Electives: A.H. 111, 112, 135, 337, 350, 374, 434; Chem. 474; A.E. 254, 255, 256, 289; Hort. 164, 224, 366, 414, 415; L.A. 208; T.Jl. 325; Econ. 130, 335; Zool. 374, 375, 384.

Produce Plant Operations.
Required: Ag. 104.
Electives: Math. 101, 102, 103, 211, 212, 213; Physics 211, 212, 213; Chem. (331, 332, 333) or (334, 335) 474; A.H. 374; D.I. 114, 258, 350.

Feed and Equipment Manufacturing, Advertising and Sales.
Required: Ag. 104.
Electives: A.H. 111, 112; Chem. 474, T.Jl. 325, 335; Ec. 335, 365, 385, 430, 480; Psych. 204.

Pre-Graduate Training.
Required: Ag. 104.
Electives: Math. 101, 102, 103, 211, 212, 213; Chem. (331, 332, 333) or (334, 335) 474; Voc.Ed. 304, 561; Phys. 211, 212, 213; M.L. 201, 202, 203, 231, 232, 233.

Program in Dairy Plant Operation

Administered by the Department of Dairy Industry.

Leading to a certificate.

This program includes the manufacture of the various milk products and the handling of market milk. The object is to fit students for positions as butter, cheese, and ice cream makers, milk plant operators, or managers of dairy plants.

For description of courses in Dairy Industry, see page 209.

First Quarter—Fall	Credits	Second Quarter—Winter	Credits
Dairy Technology D.I. 152	3	Dairy Cattle Feeding and Management A.H. 135	3
Dairy Practice D.I. 154	4	Dairy Technology D.I. 153	3
Testing Milk & Milk Products D.I. 156	4	Dairy Practice D.I. 155	4
Dairy Bacteriology D I. 265	6	Ice Cream and Ices D.I. 158	3
		Prin. of Composition Eng. 101	3
	17		16

In addition to the courses listed above, each student will be required to include in his schedule Phys.Ed. 101, 102; Ag. 104.

Third Quarter—Fall	Credits	Fourth Quarter—Winter	Credits
Dairy Machinery A.E. 269	3	Cheese Manufacture D.I. 159	3
Butter Manufacture D.I. 157	4	Condensed and Powdered Milk D.I. 258	3
Market Milk D.I. 256	3	Dairy Plant Management D.I. 260	6
Accounting I Ec. 384C	4	Special Problems D.I. 264	2
Prin. of Composition Engl. 102	3	Elements of Dairy Economics Ec. 266	3
	17		17

For undergraduate curriculum in dairy industry with major in dairy industry and chemistry and in dairy industry and economics, see page 101.

Program for Herdsmen

Administered by the Department of Animal Husbandry.

Every applicant for admission to this program must be at least sixteen years of age and must present a certificate signed by his county or high school superintendent showing that he has satisfactorily completed the eighth grade of the public schools or its equivalent. If the applicant has attended high school this certificate must also give his complete high school or academic record. This certificate should be filed with the Registrar as promptly as possible, and at least two weeks before the opening of the quarter. Formal application for admission must be filed by each applicant. Blank forms can be secured by writing to the Registrar.

Upon completion of this program and one year of successful work with livestock, a statement will be granted showing completion of the program.

For description of courses in Animal Husbandry, see page 173.

First Quarter—Winter		Credits	Second Quarter—Winter	Credits
Management of Farm Equip. A.E. 70 or Separation & Milk Testing D.I. 27 Dairy Herd Improvement A.H. 30 or Farm Sanitation V.Hyg. 3	From this group	4 or 5	Breed Studies A.H. 22	4
			Production & Feeding of Livestock A.H. 20	3
			Mkt. Classes & Grades of Livestock A.H. 29	2
			Animal Breeding A.H. 51	2
Farm Crop Production Agron. 2		4	Farm Meats A.H 71	2
Types & Mkt. Cl. of Livestock A.H. 21		3	Farm Management Ec. 36	3
General Livestock Feeding & Mgt A.H. 28		4	Livestock Advertising T.Jl. 25	2
Composition, Oral & Written Engl. 6		3		
		18 or 19		18

Training in Agriculture with Special Objectives

Training for Extension Service

Attractive opportunities are open each year in extension education in agriculture to properly qualified graduates of the division.

The preparation required for successful performance in this field varies considerably. For field workers a rather broad education in technical agriculture and related sciences, plus systematic education is highly desirable. For subject matter specialists the training required is more concentrated in one of the various areas of agricultural instruction. For both groups the special training suggested above should be supplemented by appropriate courses in psychology, speech, sociology, technical journalism and vocational education.

Students who desire to prepare for employment in extension education should, not later than their sophomore year, seek the advice of their counselors and the personnel officers of the Division of Agriculture and of the Extension Service. Junior and senior students may gain experience by working as an assistant to the County Extension Director during the summer.

Recommended courses are V.Ed. 466 and 467. Suggested electives: Psych. 204, 334,; Sp. 311, 312; Soc. 464, 486, 487; T. Jl. 225, 475; V. Ed. 305, 537, 550.

Comprehensive Regional and Town Planning Courses

Recent developments in extending local as well as national governmental activities are creating a need for technically trained men to cooperate with others in planning on a broad and comprehensive basis. Some of the immediate problems are: land and water utilization; housing; zoning; transportation; public health; conservation; recreation; agricultural engineering; site planning; technological coordination.

Special sequences in planning courses are available to students in the Divisions of Agriculture, Engineering and Science, as exemplified in the Departments of Agronomy, Architecture and Civil Engineering, Economics and Sociology, Landscape Architecture and Vocational Education.

Students interested in the application of their special techniques to comprehensive and collaborative planning programs and projects in regional or town planning, and who have a quality point average of 2.50 or higher, should consult with their heads of departments or counselors, and the Chairman, Mr. Fitzsimmons, of the special faculty collaborative planning committee.

Division of Engineering

J. F. Downie Smith, Sc.D., Dean of Division of Engineering

Frank Kerekes, C.E., Assistant Dean

Marston Hall, Room 104

The Division of Engineering, organized about 1896 with four departments, now has eleven degree-granting departments, an Engineering Experiment Station, and an Engineering Extension Service. Its faculty includes all of the members of the staffs of the eleven departments, the Experiment Station and the Extension Service.

The several curricula included in the division and the dates of their establishment are: Civil and mechanical engineering, 1868 (when the College first opened), electrical engineering, 1891, mining engineering, 1894, ceramic engineering, 1906, chemical engineering and agricultural engineering, 1909, architectural engineering, 1914, general engineering, 1926, aeronautical engineering, 1942, and architecture, 1944. The courses in theoretical and applied mechanics were brought into an organized department in 1931, and those in engineering drawing, in 1935. The Engineering Experiment Station was established in 1904, and the Engineering Extension Service was established in 1913.

Professional Degrees. The professional degrees in engineering are granted by the Iowa State College to alumni whose engineering experience has qualified them to perform engineering work of an exacting professional character. The professional degrees authorized are: Agricultural Engineer, Architectural Engineer, Ceramic Engineer, Chemical Engineer, Civil Engineer, Electrical Engineer, Industrial Engineer, Mechanical Engineer, Engineer of Mines. A detailed statement of the requirements for the professional degrees in engineering may be secured by writing to the Dean of Engineering.

Opportunities for Engineering Graduates. Engineers are employed in industries that make use of technological processes, in government service, and in a wide variety of general business fields. The readiness with which they secure the first job varies with the state of business in the country as in other lines of endeavor. In recent years most of the graduating engineers have found employment without difficulty, many of them in organizations affording an opportunity to advance to positions of considerable administrative and technical responsibility.

In all of the states except one, registration as a professional engineer is required for many types of positions. One prerequisite to registration is graduation from an accredited curriculum in engineering. The curricula at the Iowa State College are officially accredited. Generally, professional experience of two or more years is required for registration, and during this two-year period it is possible in many states for the engineer to secure a certificate as an "engineer-in-training". This rating may be secured by examination at graduation time and will continue for a reasonable period while the engineer is gaining experience. The College provides its graduating engineers with complete information about registration as an engineer-in-training and as a professional engineer.

Personnel Service. The Division of Engineering has an effective placement service. The primary function of this service is to bring to the Iowa State College

the representatives of those industrial and commercial organizations that regularly recruit personnel from among the graduates of the engineering college. The Engineering Personnel Office makes the necessary arrangements for the students of the several engineering departments to interview these representatives and aids the students in preparing for such interviews. This service is available to each member of the graduation class, to the alumni who desire to change positions, and to those undergraduates who plan to stay out of college for a time or who seek industrial experience during vacation periods.

HONOR FRATERNITIES. Tau Beta Pi is a national honorary engineering society maintaining a chapter on the Iowa State College campus. A chapter of Eta Kappa Nu chooses its membership from students in electrical engineering, Keramos from students in ceramic engineering, Pi Tau Sigma from students in mechanical engineering, and Tau Sigma Delta from those in architecture and architectural engineering. Among the other honor fraternities open to students in the Division of Engineering are the following:

Sigma Xi	All College	Men and Women
Phi Kappa Phi	All College	Men and Women
Cardinal Key	All College	Men
Phi Lambda Upsilon	Chemistry	Men

ENGINEERING AND ARCHITECTURAL SOCIETIES. General professional association and advancement are promoted by the activities of the student branches of the great national engineering and architectural societies of which the following are represented at Iowa State College: American Ceramic Society, American Institute of Electrical Engineers, American Society of Agricultural Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Chemical Engineers, American Institute of Mining and Metallurigical Engineers, Institute of the Aeronautical Sciences, Society for the Advancement of Management, and American Institute of Architects.

THE ENGINEERING COUNCIL is the governing body of the student organizations in the Division of Engineering. The council is made up of delegates representing all the departmental student technical societies and directs certain activities that are carried out by the student body. Among these are the Engineering Carnival, in the fall, the Engineering Open House, every spring, and engineering social affairs. The council each year invites a few prominent engineers to visit the College and address the students on subjects of general interest to the profession.

THE IOWA ENGINEER. The engineering students publish monthly during the college year an engineering journal called *The Iowa Engineer*. Articles are contributed by engineering alumni, nonresident engineering lecturers, and members of the engineering faculty, as well as by the student editors and reporters. Engineering journals are becoming so numerous and important that experience on *The Iowa Engineer* staff is very valuable.

THE CHARLES FREDERICK BOWERS MEMORIAL PRIZE. The Charles Frederick Bowers Memorial prize is derived from the earnings from a fund which was contributed by former students, friends and associates of the late Professor Bowers who lost his life in the service of his country in World War II. The earnings from this fund are awarded annually to the outstanding senior student in the curriculum in architectural engineering. The selection is made by a faculty committee on the basis of the student's work during his senior year.

Curricula in Engineering

Objectives

Engineering education is distinctive in that its aim is to develop a type of thinking that is objective and analytical. It requires a sound knowledge of English, of the broad basic sciences of chemistry, physics, mathematics, and economics, and of the specialized branches of these sciences peculiar to a particular field of engineering. The training is characterized by practice in analyzing and solving problems and situations of a nature common in professional engineering. Since engineers deal with problems involving human relations as well as the materials and forces of nature, the several engineering curricula allocate about one-fourth of the time of the student to courses in psychology, sociology, economics, history, literature, government, and law. Special attention is devoted to development of the ability of the student to write and speak well.

The curricula in engineering at the Iowa State College have been adjusted recently to permit a more thorough training in the outlined four years in the basic sciences and professional engineering courses, and to increase the subject matter to some degree in the humanities. The broad objective of the engineering curricula is to develop the student to professional competence in one of the fields of engineering and by breadth of training to enable him to participate as a leader in the affairs of his profession and his community, the state, and the nation.

More advanced work in the engineering sciences and their application to engineering are offered in the postgraduate programs of the several departments. For details of graduate study in engineering, prospective students are referred to the Graduate College Catalogue.

Organization of Curricula

The basic sciences constitute about one-third of the program and are taught principally in the freshman and sophomore years, but the student establishes and maintains contact with engineering courses from his first quarter of school work. The applied science and engineering courses are for the most part concentrated in the last two years of the curricula. A distinctive feature of all of the engineering curricula at the Iowa State College is that an early foundation in mathematics permits the teaching of more rigorous courses in the physical sciences, which are at the foundation, and which strengthen the entire four-year program.

Prerequisites to Engineering

To fully meet the requirements for admission to the Division of Engineering the student should present one unit of plane geometry, one and one-half units of algebra and either one-half unit of plane trigonometry or an additional one-half unit of algebra. Students who have not completed all of these mathematics courses may take geometry, third and fourth semester algebra or plane trigonometry at the Iowa State College.

It is also highly desirable that the high school student have completed three or four units of English, and all of the mathematics and science courses that are available to him in his high school, since these subjects form the core of the engineering curricula.

Every student should plan his mathematics sequence with his counselor's assistance at the earliest opportunity in order to minimize the time required to become eligible for the sequence courses of the sophomore year.

Uniform Freshman Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
[1]General Chemistry Chem. 101	4	[1]General Chemistry Chem. 102	4	[1]General Chemistry Chem 103	4
Mathematics*	5	Analytical Geometry Math. 103	5	Diff. & Int. Calc. I Math. 211	5
Engineering Problems Gen.E. 105**	1	Engineering Problems Gen.E. 106	1	Engineering Problems Gen. E. 122	1
Drawing & Projection E.Dr. 131	2	Projective Drawing E.Dr. 132	3	[4]Working Drawings E.Dr. 133	3
Prin. of Composition Engl. 101	3	Prin. of Composition Engl. 102	3	Prin. of Composition Engl. 103	3
[2]Military Science I Mil. 111 or	1	[2]Military Science I Mil. 112 or	1	[2]Military Science I Mil. 113 or	1
[3]Naval Science N.S. 111	3	[3]Naval Science N.S. 112	3	[3]Naval Science N.S. 113	3
	16		17		17
N.R.O.T.C. Students	18	N.R.O.T.C. Students	19	N.R.O.T.C. Students	19

In addition to the courses listed above, each student will include in his schedule: Phys.Ed. 101, 102, 103; Libr. 106C (Winter); Engr. 114, 115, Departmental Technical Lecture 100 (Spring).

A student who transfers to an engineering curriculum after having completed Math. 211 shall take in the first term of his work in Engineering Gen.E 108 in lieu of Gen.E. 105, 106, and 122. A student who transfers to an engineering curriculum with senior college classification is not required to take Gen.E. 105, 106, 122, or 108, but his counselor may advise him to take Gen.E. 108.

SELECTION OF CURRICULUM BY THE STUDENT. The program of the freshman year is identical for all curricula in the Division of Engineering, and entering freshmen are not required to select the curriculum they wish to follow until near the end of the freshman year.

The student can change his curriculum up to the end of the sophomore year without much loss of credit. To do so he needs only to secure the consent of the Dean of Engineering and the Dean of Junior College and comply with the faculty rules relating to such changes.

Engineering students who wish to elect a sequence in Technical Journalism may arrange such a program upon approval of the head of the student's engineering department and the head of the department of Technical Journalism. See page 305 for description of courses.

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[1]A student who has completed 1 unit of chemistry prior to admission to Iowa State College and who performs satisfactorily in a placement test, or who otherwise qualifies, should enroll in Chem. 101C and continue with Chem. 102C and 103C. Other students will enroll in Chem. 101 and continue with 102 and 103.

[2]May be omitted by students appointed to N.R.O.T.C.

[3]May be taken only by students appointed to N.R.O.T.C.

[4]Architecture and Architectural Engineering students will take Arch. 103, Cr. 3.

*Registration in mathematics in the first quarter of the freshman year will be based upon the amount and nature of high school units of mathematics presented upon entrance.

**Gen.E. 105 will accompany classification in Math. 102C.

Aeronautical Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
General Aeronautics Aero.E. 221	3	Aircraft Materials Aero.E. 222	2	Aircraft Construction Aero.E. 223	2
Diff. and Int. Calc. II Math. 212	4	Diff. & Int. Calc. III Math. 213	4	Differential Equations Math. 314	3
General Physics Phys. 221	5	General Physics Phys. 222	5	General Physics Phys. 223	5
Physical Metallurgy M.E. 211	3	Statics of Engineering T.&A.M. 274	4	Dynamics T.&A.M. 344	4
Machine Shop M.E. 201	2	Prin. of Economics Ec. 261	3	Prin. of Economics Ec. 262	3
[1]Military Science	1	[1]Military Science	1	[1]Military Science	1
	18		19		18

Junior Year

Aeronautical Problems Aero.E. 301	3	Aerodynamics I Aero.E. 310	4	Aerodynamics II Aero.E. 360	4
Mechanics of Fluids T.&A.M. 378	4	Mechanics of Materials T.&A.M. 324	5	Stress Analysis I Aero.E. 380	5
Kinematics M.E. 310	4	Machine Analysis M.E. 312	4	Design of Mach. Elements M.E. 315	4
Thermodynamics M.E. 344	5	Materials Laboratory T.&A.M. 327	1	Speech-Making Sp. 311	3
[2]Introd. to Sociology Soc. 234B	3	[2]Writing of Scientific Papers Engl. 414	3	[2]Business Law Ec. 365A	3
	19		17		19

Senior Year

Stability & Control Aero.E. 410	3	Airplane Design I Aero.E. 430	4	Airplane Design II Aero.E. 432	4
Stress Analysis II Aero.E. 420	4	Stability of Aircraft Struc. Aero.E. 422	3	Flight Testing Aero.E. 440	4
Internal Combustion Engr. M.E. 445	4	Reaction Propulsion Aero.E. 411	3	American Government Govt. 315B	3
Aircraft Vibration & Flutter, T.&A.M. 444	4	D C. Circuits and Machines, E.E. 435	4	A.C. Circuits and Machines, E.E. 437	4
[2]Electives	3	[2]Electives	3	[2]Electives	3
	18		17		18

[1]These courses may be replaced by Naval Science courses by NROTC students.
[2]These courses may be replaced by either Military Science or Naval Science by either ROTC or NROTC students.

Curriculum in Agricultural Engineering

Administered jointly by the Division of Agriculture and the Division of Engineering.

Leading to the degree of Bachelor of Science.

Six months of practical work in agriculture or engineering under the direction of this department is required before graduation.

For freshman year, see page 114.

Sophomore Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Agricultural Machines A.E. 236	3	Crop Production Agron. 111	3	Fundamentals of Soil & Water Cons. Engr. A.E. 224	5
Surveying C.E. 325	3	Diff. & Int. Calculus III Math. 213	4	Crop Production Agron. 112	4
Diff. & Int. Calculus II Math. 212	4	Machine Shop M.E. 201	2	Livestock Problems A.H. 112	3
General Physics Phys. 221	5	General Physics Phys. 222	5	General Physics Phys. 223	5
Speech-Making Speech 311	3	Statics of Engineering T.&A.M. 274	4	Military Science	1
Military Science	1	Military Science	1	or	
or		or		[1]Naval Science N.S. 213	3
[1]Naval Science N.S. 211	3	[1]Naval Science N.S. 212	3		
	19 or 21		19 or 21		18 or 20

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Junior Year

[2]Wood Construction A.E. 355	2	Principles of Economics Ec. 231	3	Agr. Tractor Power A.E. 346	4
Machine Construction A.E. 359	2	Hist. of Amer. Agr. Hist. 324	3	Soils Agron. 154	4
Fundamentals of Agr. Str. Design, A.E. 375	5	[2]Physical Metallurgy M.E. 211	3	Principles of Economics Ec. 232	3
Differential Equations Math. 314	3	Thermodynamics M.E. 344	5	[2]Engineering Contracts M.E. 480	3
Mech. of Materials T.&A.M. 324	5	Dynamics of Engineering T.&A.M. 344	4	Mechanics of Fluids T.&A.M. 378	4
Materials Laboratory T.&A.M. 327	1				
	18		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, A.E. 301, 302, 303.

Senior Year

Soil & Water Cons. Engr., A.E. 425	5	Irrigation A.E. 427	3	Adv. Agr. Str. Design A.E. 476	4
Livestock Feeding and Management, A.H. 216	3	Agr. Engr. Applications A E. 447	3	Farm Electrification A.E. 462	3
D.C. Circuits & Mach. E.E. 435	4	A.C. Circuits & Mach. E.E. 437	4	Farm Utilities A.E. 487	3
[3]Technical Electives	5	[2]American Government Govt. 315B	3	[2]Farm Mgt. & Org. Ec. 330	4
		[3]Technical Electives	4	[3]Technical Electives	4
	17		17		18

In addition to the courses listed above, each student will be required to include in his schedule: Inspection Trip, A.E. 400 (Fall); Seminar A.E., 401, 402, 403.

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[1]May be taken only by students appointed to the N.R.O.T.C.
[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.
[3]Technical Electives: In the senior year the student will elect one of the following optional groups and take all of the courses listed in such group:

Farm Power and Machinery.
Kinematics, M.E. 310, 4 cr.
Design of Machine Elements, M.E. 315, 4 cr.
Advanced Farm Machinery, A.E. 436, 4 cr.
Note: M.E. 312, Machine Analysis, will not be required.

Farm Structures.
Heat Transfer, M.E. 325, 3 cr.
Refrigeration & Air Conditioning, M.E. 426, 4 cr.
Elements of Structures, C.E. 331, 5 cr.

Rural Electrification.
Heat Transfer, M.E. 325, 3 cr.
Refrigeration & Air Conditioning, M.E. 426, 4 cr.
Application of Electronics, E.E. 439, 3 cr.

Soil and Water Conservation.
Soil Conservation and Erosion Control, Agron. 464, 3 cr.
Soil Engineering, C.E. 360, 5 cr.
Engineering Geology, Geol. 374, 3 cr.

Additional electives must be approved in advance by the head of the department.

Curriculum in Architecture

Leading to the degree of Bachelor of Architecture.

For freshman year, see page 114.

Sophomore Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Architectural Design & Sketching, Arch. 201	5	Architectural Design & Sketching, Arch. 202	5	Architectural Design & Theory of Color Arch. 203	5
Principles of Economics Ec. 261	3	Principles of Economics Ec. 262	3	Surveying C.E. 325	3
Diff. & Int. Calculus II Math. 212	4	Diff. & Int. Calculus III Math. 213	4	General Physics Phys. 223	5
General Physics Phys. 221	5	General Physics Phys. 222	5	Statics of Engineering T.&A.M. 274	4
Military Science	1	Military Science	1	Military Science	1
or		or		or	
[1]Naval Science N.S. 211	3	[1]Naval Science N.S. 212	3	[1]Naval Science N.S. 213	3
	18 or 20		18 or 20		18 or 20

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203 and Seminar, Arch. 200 (Fall).

Junior Year

Architectural Design Arch. 304	4	Architectural Design Arch. 305	4	Architectural Design Arch. 306	4
History of Architecture Arch. 351	3	History of Architecture Arch. 352	3	History of Architecture Arch. 353	3
Introduction to Western Civilization, Hist. 311	3	Introduction to Western Civilization, Hist. 312	3	Elements of Structures C.E. 331	5
Mechanics of Materials T.&A.M. 324	5	Engineering Materials T.&A.M. 358	5	Introduction to Western Civilization, Hist. 313	3
[2]Electives	3	[2]Electives	3	[2]Electives	3
	18		18		18

Senior Year

Architectural Design & Advanced Sketching Arch. 416	7	Architectural Design & Advanced Sketching Arch. 417	7	Architectural Design & Theory of Color Arch. 418	7
History of Painting & Sculpture, Arch. 408	3	Truss-Frame Structures C.E. 433	5	Foundations & Masonry Structures, C.E. 434	5
Continuous-Frame Structures, C.E. 432	5	American Masterpieces Engl. 364	3	World Literature Engl. 354	3
[2]City or Town Planning L.A. 401	3	[2]Elective	3	[2]Elective	3
	18		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Inspection Trip, Arch. 400 (Fall); and Seminar, Arch. 410 (Spring).

Fifth Year

Sculptural Design A.A. 400D	3	Architectural Design & Decorative Details Arch. 522	7	Specifications & Estimating Arch. 412	5
Architectural Design & Decorative Details Arch. 521	7	Collaborative Planning L.A. 514	3	Arch. Office Practice Arch. 523	7
Elec. Appl. in Bldgs. E.E. 355	5	Heating & Ventilation M.E. 432	5	Special Planning Projects L.A. 515	3
Electives	3	Electives	3	Electives	3
	18		18		18

Electives must be approved in advance by the head of the department. It is strongly recommended that the student select a sequence of elective courses such as Modern Language 201, 202, 203 or individual electives of related subject matter.

[1]May be taken only by students appointed to N.R.O.T.C.
[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.

Curriculum in Architectural Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

For sophomore and junior years, see curriculum in Architecture, page 117.

Senior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Design Analysis Arch. E. 413	5	Design Analysis Arch. E. 414	5	Arch. Office Practice Arch. E. 423	5
Continuous-Frame Structures, C.E. 432	5	Truss-Frame Structures C.E. 433	5	Specifications and Estimating, Arch. 412	5
Elec. Applic. in Bldgs. E.E. 355	5	Heating & Ventilation M.E. 432	5	Foundations & Masonry Structures, C.E. 434	5
[3]Electives	3	[3]Electives	3	[2]Mech. Equip. of Bldgs. M.E. 490	3
	18		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Inspection Trip, Arch. 400 (Fall); and Seminar, Arch. 410 (Spring).

[3]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.
Electives must be approved in advance by the head of the department. It is strongly recommended that the student select individual electives of related subject matter.

Curriculum in Ceramic Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Winning & Forming Cer.E. 206	4	Cer. Raw Materials Cer. E. 207	4	Drying & Firing Cer.E. 208	4
Quantitative Analysis Chem. 211	4	Mineralogy Geol. 355	4	Quantitative Analysis Chem. 214	4
Diff & Int. Calculus II Math. 212	4	Diff. & Int. Calculus III Math. 213	4	General Physics Phys. 223	5
General Physics Phys. 221	5	General Physics Phys. 222	5	Statics of Engineering T.&A M. 274	4
Military Science	1	Military Science	1	Military Science	1
or		or		or	
[1]Naval Science N.S. 211	3	[1]Naval Science N.S. 212	3	[1]Naval Science N.S. 213	3
	18 or 20		18 or 20		18 or 20

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203; Seminar, Cer.E. 201, 202, 203.

Junior Year

Phys. & Chem. Prop. of Cer. Materials Cer.E. 309	6	Bodies, Glazes & Colors Cer.E. 315	3	Enamels Cer.E. 316	4
Physical Chemistry Chem. 321	4	Physical Chemistry Chem. 322	4	Physical Chemistry Chem. 323	4
[3]Speech-Making Speech 311	3	Principles of Economics Ec. 261	3	Elements of Structures C.E. 331	5
Mechanics of Materials T.&A.M. 324	5	Materials Laboratory T.&A.M. 327	1	[2]Principles of Economics Ec. 262	3
		Dynamics of Engineering T.&A.M. 344	4	Geology for Engineers Geol. 374	3
		[3]Electives	3		
	18		18		19

In addition to the courses listed above, each student will be required to include in his schedule: Cer.E. 301, 302, and 303.

[1]May be taken only by students appointed to N.R.O.T.C.
[3]Three credits may be omitted by students appointed to R.O.T.C. or N.R.O.T.C. each quarter in junior and senior years.
All electives must be approved in advance by the head of the department.

Senior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Glass Technology Cer.E. 406	3	Cer. Prod. Dev. & Control Cer.E. 411	4	Refractories Cer.E. 404	3
Cer. Engr. Design Cer.E. 424	5	Cer. Engr. Design Cer.E. 425	4	Cer. Prod. Dev. & Control Cer.E. 412	3
Optical Mineralogy Geol. 454	4	Electrical Applications E.E. 434	3	Engineering Reports C.E. 484	3
[2]Electives	6	[2]Electives	6	American Government Govt. 315B	3
				[2]Electives	6
	18		17		18

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, Cer.E. 401, 402, 403; Inspection Trip, Cer.E. 400 (Fall).

[2]Three credits may be omitted by students appointed to R.O.T.C. or N.R.O.T.C. each quarter in junior and senior years.

All electives must be approved in advance by the head of the department.

Curriculum in Chemical Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Quantitative Analysis Chem. 215	5	Quantitative Analysis Chem. 216	5	Quantitative Analysis Chem. 217	5
Introd. to Chem Engineering Chem.E. 200	3	Diff. & Int. Calculus III Math. 213	4	Industrial Stoichiometry Chem.E. 303	3
Diff. & Int. Calculus II Math. 212	4	General Physics Phys. 222	5	General Physics Phys. 223	5
General Physics Phys. 221	5	Statics of Engr. T.&A.M. 274	4	Dynamics of Engr. T.&A.M. 344	4
Military Science	1	Military Science	1	Military Science	1
or		or		or	
[1]Naval Science N.S. 211	3	[1]Naval Science N.S. 212	3	[1]Naval Science N.S. 213	3
	18 or 20		19 or 21		18 or 20

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.
Summer Plant, 170 hours.

Junior Year

[2]Machine Shop M.E. 201	2	Metal Fabrication M.E. 204	2	Physical Chemistry Chem. 323	4
Physical Chemistry Chem. 321	4	Physical Chemistry Chem. 322	4	Lab. in Organic Chemistry Chem. 330	2
Lab. in Organic Chemistry Chem. 330	2	Lab. in Organic Chemistry Chem. 330	2	Organic Chemistry Chem. 333	3
Organic Chemistry Chem. 331	3	Organic Chemistry Chem. 332	3	Chem. E. Unit Operations Chem.E. 363	3
Chem. E. Unit Operations Chem.E. 361	3	Chem. E. Unit Operations Chem.E. 362	3	Engineering Reports C.E. 484	3
Mechanics of Materials T.&A.M. 324	5	[2]Speech-Making Speech 311	3	[2]American Government Govt. 315B	3
		Materials Laboratory T &A.M. 327	1		
	19		18		18

[1]May be taken only by students appointed to N.R.O.T.C.
[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.

Senior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Chem. Process Industries Chem.E. 411	3	Chem. Process Industries Chem.E. 412	3	Chem. Process Industries Chem.E. 413	3
Chem. E. Lab. Chem.E. 421	3	Chem. E. Lab. Chem.E. 422	3	Chem. E. Lab. Chem.E. 423	3
Chem. E. Design Chem.E. 471	3	Chem. E. Design Chem.E. 472	3	Special Problems Chem.E. 466	2
Chem. E. Thermodynamics Chem.E. 461	3	Special Problems Chem.E. 465	2	Chem. E. Design Chem.E. 473	2
[2]Principles of Economics Ec. 261	3	A.C. Circuits & Machines E.E. 437	4	Industrial Organization Gen.E. 351	3
D.C. Circuits & Machines E.E. 435	4	[2]Non-technical Electives	3	[2]Non-technical Electives	3
				Chem.E Electives	3
	19		18		19

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, Chem.E. 401, 402, 403; and Senior Inspection Trip, Chem. E. 400 (Fall).

[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.

In addition, N.R.O.T.C. students will take N.S. 311 and R.O.T.C. students will take Mil. 301, 321, 331, or Air Science 341 and may omit Chem.E. electives in the senior year, spring quarter.

All electives must be approved in advance by the head of the department.

Curriculum in Civil Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Elementary Surveying C.E. 211	5	Top. & Cadastral Survey C.E. 212	3	Route & Higher Survey C.E. 213	4
Engineering Geology Geol. 374	3	General Physics Phys. 222	5	Principles of Economics Ec. 261	3
Diff. & Int. Calculus II Math. 212	4	Diff. & Int. Calculus III Math. 213	4	General Physics Phys. 223	5
General Physics Phys. 221	5	Statics of Engineering T.&A M 274	4	Mechanics of Materials T.&A.M. 324	5
Military Science	1	Military Science	1	Military Science	1
or		or		or	
[1]Naval Science N.S. 211	3	[1]Naval Science N.S. 212	3	[1]Naval Science N.S. 213	3
	18 or 20		17 or 19		18 or 20

Summer field work and topographic and route surveying, six weeks. Summer Camp, C.E. 300, 9 credits.

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Junior Year

General Bacteriology Bact. 304D	3	Highway & Airport Pavements C.E. 355	4	Highway & Street Design C.E. 356	3
Soil Engineering C.E. 360	5	Railway Engineering C.E. 364	3	Elements of Structures C.E. 331	5
Principles of Economics Ec. 262	3	Accounting I Ec. 384A	3	Speech-Making Sp. 311	3
[2]Introduction to Sociology Soc. 234B	3	[2]American Government Govt. 315B	3	[2]Municipal Govt. & Admin. Govt. 437	3
Dynamics of Engr. T.&A.M. 344	4	Engineering Materials T.&A.M. 358	5	Mechanics of Fluids T.&A.M. 378	4
	18		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, C.E. 394 (Fall) and 395 (Spring).

[1]May be taken only by students appointed to N.R.O.T.C.

[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.

Senior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Sewerage & Sewage Treatment C.E. 422	4	Water Supply Engr. C.E. 423	4	Hydrology & Water Power Engr. C.E. 421	4
Continuous-Frame Struct. C.E. 432	5	Truss-Frame Structures C.E. 433	5	Foundations & Masonry Structures C.E. 434	5
Engineering Construction C.E. 485	4	Engineering Reports C.E. 484	3	Engineering Economy Gen.E. 404	3
[2]Economics of Industrial Relations Ec. 305	3	Electrical Applications E.E. 434	3	[2]Electives	6
Business Law 1 Ec. 365A	3	[2]Electives	3		
	19		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, C.E. 496 (Fall) and 497 (Winter); Inspection Trip, C.E. 400 (Fall).

[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.

Elective courses shall be chosen after consultation with the senior college counselor.

Students who wish to prepare for careers in the sanitary and public health fields should make that decision early in the junior year so that their programs may be arranged accordingly.

Curriculum in Electrical Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Principles of Economics Ec. 261	3	Elec. & Mag. Circuits E.E. 212	5	Principles of Economics Ec. 262	3
Fund. of Elec. Engr. E.E. 211	4	Diff & Int. Calculus III Math. 213	4	Elec. & Mag. Fields E.E. 213	6
Diff. & Int. Calculus II Math. 212	4	General Physics Phys. 222	5	American Government Govt. 315B	3
General Physics Phys. 221	5	Statics of Engineering T &A.M. 274	4	Dynamics of Engineering T.&A.M. 344	4
Military Science or [1]Naval Science N S. 211	1 or 3	Military Science or [1]Naval Science N S. 212	1 or 3	Military Science or [1]Naval Science N.S. 213	1 or 3
	17 or 19		19 or 21		17 or 19

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Junior Year

[2]Accounting I Ec. 384A	3	A.C. Circuits E.E. 302	4	[2]Business Law I Ec. 365A	3
A.C. Circuits E.E. 301	6	Electronics E.E. 474	6	A C. Circuits E.E. 303	6
Advanced Math. for E.E. Math. 316	5	Mechanics of Materials T.&A.M. 324	5	Elec. Machinery E E 401	6
Thermodynamics M.E. 344	5	[2]Speech-Making Speech 311	3	Elec. Measurements E.E. 366	2
				Materials Laboratory T.&A.M. 327	1
	19		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, E.E. 300 (Spring).

[1]May be taken only by students appointed to N.R.O.T.C.
[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.

Senior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Elec. Machinery E.E. 402	6	Prin. of Illumination E.E. 485	4	Engineering Analysis E.E. 408	4
Writing of Scientific Papers Engl. 414	3	Business Correspondence Engl. 404	2	Personnel Supervision Gen.E. 425	3
Industrial Organization Gen.E. 351	3	[3]Technical Electives (See list below)	8	[3]Technical Electives (See list below)	8
[3]Technical Electives (See list below)	4	[2]Electives	3	[2]Electives	3
[2]Electives	3				
	19		17		18

In addition to the courses listed above, each student will be required to include in his schedule: Inspection Trip, E.E. 400 (Fall).

[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.

[3]Technical electives are to be chosen from the following:

		Electric Machinery E.E. 403	4	Med. Freq. Circuits E.E. 479	4
Industrial Electronics E.E. 475	4	Power Transmission E.E. 465	4	Power System Engineering E.E. 466	4
Theory of Elec. Networks E.E. 424	4	Radio Engineering E.E. 457	4	Radio Engineering E.E. 458	4
		Recurrent Elec. Transients E E. 426	4	UHF Circuits E.E. 484	4
				Power Generation M.E. 456	4

All electives must be approved in advance by the head of the department.

Curriculum in General Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Surveying C.E. 325	3	Prin of Econ. Ec. 261	3	Prin. of Economics Ec. 262	3
Diff. & Int. Calc II Math. 212	4	Diff. & Int. Calc. III Math. 213	4	Metal Fabrication M.E. 204	2
Machine Shop M.E. 201	2	Motion Study Gen.E. 223	2	Gen. Psych. Psych. 204	3
General Physics Phys. 221	5	General Physics Phys. 222	5	General Physics Phys. 223	5
Speech-Making Sp. 311	3	Statics of Engr T &A.M. 274	4	Dynamics of Engr. T.&.A.M. 344	4
Military Science or	1	Military Science or	1	Military Science or	1
[2]Naval Science N.S. 211	3	[2]Naval Science N.S. 212	3	[2]Naval Science N.S. 213	3
	18 or 20		19 or 21		18 or 20

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203; Seminar, Gen.E. 213 (Spring).

[2]May be taken only by students appointed to N.R O.T.C.

Prior to enrolling for the Junior Year the student must elect his option from the Industrial, Management or Law programs.

Industrial Option

Junior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Accounting I Ec. 384A	4	A. C. Circuits & Machines E.E. 339	4	Time & Motion Study Gen.E. 435	3
D C. Circuits & Machines E.E. 338	4	Cost Accounting Ec. 480	4	A.C. Machines E.E. 340	4
Industrial Org. Gen E. 351	3	Calc. & Graphic Methods Gen.E. 362	3	Tool Engineering M.E. 305	3
[2]Employment Methods & Employee Develop. Gen.E. 354	3	Materials Lab. T.&A.M. 327	1	[2]Fluid Mechanics T.&A.M. 378	4
Mechanics of Matls. T.&A.M. 324	5	Engr. Materials T.&A.M. 354	3	Thermodynamics M.E. 344	5
		[2]Public Address Sp. 312 or [2]Persuasion Sp. 334	3		
	19		18		19

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, Gen.E. 311 (Fall).

Senior Year

Industrial Engr. Gen.E. 441	5	Industrial Engr. Gen.E. 442	5	Industrial Engineering Gen.E. 443	5
Engineering Economy Gen.E. 404	3	Principles of Personnel Supervision Gen.E. 425	3	Engineering Valuation Gen.E. 407	3
Safety Engineering Gen.E. 421	3	Heat Engines M.E. 443	3	Job Evaluation Gen.E. 432	4
Standard Time Determination Gen.E. 436	3	Industrial Marketing Ec. 468 or Sales Engineering Gen.E. 430	3	[2]Engineering Contracts M.E. 480	3
Writing Scientific Papers Engl. 414	3	[2]American Government Govt. 315B	3	[2]Electives	3
	17		17		18

In addition to the courses listed above, each student will be required to include in his schedule. Seminar, Gen.E. 412 (Winter); Senior Inspection Trip, Gen.E. 400 (Fall).

[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.

Management Option

The student who selects this option is required to take 6 or more of the 16 elective credits from a sequence of technical courses. His sequence should be chosen early in the junior year and must be from courses approved in advance by the head of the department. The following courses meet this requirement:

TECHNICAL ELECTIVES:

Math. 314 and M.E. 325	C.E. 354 and C.E. 356	Ec. 385, 386, 481, 485
M.E. 310 and M.E. 305	C.E. 354 and C.E. 404	Ec. 474, 475, 575, 365A and 477
M E. 310 and M.E. 322	C.E. 432 and C.E. 485	Stat. 401, 402 and either Stat. 431, 341 or Gen.E. 462
M.E. 440 and M.E. 445	C E. 432 and C.E. 360	R.O.T.C.
M.E. 440 and M.E. 443	C.E. 360 and C.E. 356	N.R.O.T.C.
M.E. 440 and M.E. 456	C.E. 421 and C.E. 485	
Math. 314 and T.&A.M. 544	C.E. 485 and M.E. 480	
Math. 314 and E.E. 439	Aero.E. 310 and Aero.E. 360	
Math. 314 and E.E. 485	C.E. 360 and C.E. 485	

The above requirement of 6 or more credits may be waived for a student who desires to elect a sequence of courses totaling at least 12 credits in technical journalism or certain other non-technical fields when approved in advance by the head of the department.

Junior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Accounting I Ec. 384A	4	Cost Accounting Ec. 480	4	A.C. Machines E.E. 340	4
D C. Circuits & Mach. E.E. 338	4	A C Circuits & Mach. E E. 339	4	Thermodynamics M E. 344	5
Industrial Org. Gen.E. 351	3	Calc. & Graphic Methods Gen E. 362	3	Industrial Psych. Psych. 465	3
[2]Employment Methods & Employee Dev. Gen.E. 354	3	[2]Public Address Sp. 312 or [2]Persuasion Sp. 334	3	[2]Fluid Mechanics T.&A.M. 378	4
Mechanics of Matls. T &A.M. 324	5	Engr. Materials T.&A.M. 354	3	Time & Motion Study Gen.E. 435	3
		Materials Lab. T.&A.M. 327	1		
	19		18		19

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, Gen E. 311 (Fall).

Senior Year

Elements of Struct. C E. 331	5	Industrial Marketing Ec. 468	3	Industrial Relations Ec. 305	3
Writing of Sci. Papers Engl. 414	3	Sales Engineering Gen.E. 430	3	Industrial Management Gen E. 452	3
[2]American Govt. Govt 315B	3	Engineering Economy Gen.E. 404	3	Engineering Valuation Gen.E. 407	3
Job Evaluation Gen E. 432	4	Prin of Personnel Supervision Gen E. 425	3	[3]Electives	8
[3]Electives	3	[3]Electives	5		
	18		17		17

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, Gen E. 412 (Winter); Senior Inspection Trip, Gen.E. 400 (Fall).

[2]May be omitted by students appointed to R O.T.C. or N.R.O T.C.
[3]At least 6 credits from Technical Elective listing.

Curriculum in Mechanical Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Principles of Economics Ec. 261	3	Metal Casting M.E. 202	2	Principles of Economics Ec. 262	3
Diff. & Int. Calculus II Math. 212	4	Diff. & Int. Calculus III Math. 213	4	Metal Fabrication M.E. 204	2
Machine Shop M.E. 201	2	Physical Metallurgy M.E. 212	3	Physical Metallurgy M.E. 213	3
Physical Metallurgy M.E. 211	3	General Physics Phys. 222	5	General Physics Phys. 223	5
General Physics Phys. 221	5	Statics of Engineering T &A M. 274	4	Dynamics of Engineering T.&A.M. 344	4
Military Science or [1]Naval Science N.S. 211	1 or 3	Military Science or [1]Naval Science N.S. 212	1 or 3	Military Science or [1]Naval Science N.S. 213	1 or 3
	18 or 20		19 or 21		18 or 20

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

[1]May be taken only by students appointed to N R O T C.

Junior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Differential Equations Math. 314	3	[2]American Government Govt. 315B	3	Industrial Organization Gen.E. 351	3
Kinematics M.E. 310	4	Machine Analysis M.E. 312	4	[2]Ec. Hist. of U. S. Hist. 335	3
Thermodynamics M.E. 321	4	Thermodynamics M.E. 322	4	Design of Machine Elements, M.E. 315	4
[2]Speech-Making Speech 311	3	Thermodynamics Lab. M.E. 342	1	Heat Transfer M.E. 325	3
Mechanics of Fluids T.&A.M. 378	4	Mechanics of Materials T.&A.M. 324	5	Mechanical Laboratory M.E. 343	1
		Materials Laboratory T.&A.M. 327	1	Fuels and Combustion M.E. 440	4
	18		18		18

Senior Year

Accounting I Ec. 384A	3	A.C. Circuits & Machines E.E. 339	4	A.C. Machines E.E. 340	4
[2]American Masterpieces Engl. 364	3	Writing of Scien. Papers Engl. 414	3	Internal Comb. Engines M.E. 445	4
D.C. Circuits & Machines E.E. 338	4	Steam Power Equipment M.E. 444	4	Engineering Contracts M.E. 480	3
Refrig. & Air Conditioning M.E. 426	4	Tech. Electives	4	Tech. Electives	4
Machine Design M.E. 423	4	[2]Non-technical Electives	3	[2]Non-technical Electives	3
	18		18		18

In addition to the courses listed above, each student will be required to include in his schedule Inspection Trip, M.E. 400 (Fall).

[2]May be omitted by students appointed to R.O.T C. or N.R.O.T.C.

SENIOR ELECTIVES: It is recommended that non-technical electives be chosen from the fields of biological science, psychology, history, language, or literature. Technical electives will be chosen from one of the following groups. All electives are subject to approval in advance by the head of the department.

Group 1	Credits	Group 2	Credits
Heat and Air Cond. Design M.E. 427	4	Cost Accounting Ec. 480	4
Int. Comb. Engine Design M.E. 429	4	Engineering Valuation Gen.E. 407	3
Airplane Engines M.E. 450	4	Motion and Time Study M.E. 455	2
Steam Power Plant Design M.E. 448	4	Industrial Engineering Gen.E. 486	3
Diesel Engines M.E. 467	3	Factory Planning Gen.E. 489	3

Group 3		Group 4	
Industrial Metallurgy M.E. 435	3	Application of Electronics E.E. 439	3
Adv. Mechanics of Materials T.&A.M. 514	3	Differential Equations Math. 315	3
Adv. Mechanics of Materials Lab T.&A.M. 517	1 or 2	Adv. Math. in Engineering Math. 451, 452, 453	3 each
Adv. Technical Statics T.&A.M. 524	3 or 4	Physical Measurements Phys. 311	1
Mech. Vibrations T.&A.M. 544	4	Heat Phys. 404	3
Advanced Engineering Dynamics T.&A.M. 548	4	Introduction to Modern Physics Phys. 421	3
		Principles of Similitude T &A.M. 484	4

Curriculum in Mining Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Quantitative Analysis Chem. 211	4	Quantitative Analysis Chem. 212	4	General Geology Geol. 203	4
Diff. & Int. Calculus II Math. 212	4	General Geology Geol. 202	4	Industrial Stoichiometry Mn.E. 304	3
General Physics Phys. 221	5	Diff. & Int. Calculus III Math. 213	4	General Physics Phys. 223	5
Military Science	1	General Physics Phys. 222	5	Statics of Engineering T.&A.M. 274	4
or		Military Science	1	Military Science	1
[1]Naval Science N.S. 211	3	or		or	
Non-technical Elective	3	[1]Naval Science N.S. 212	3	[1]Naval Science N.S. 213	3
				Non-technical Electives	3
	17 or 19		18 or 20		20 or 22

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Field trip or summer mine practice, 170 hours.

Junior Year

Plane Surveying C.E. 325	3	[2]Principles of Economics Ec. 261	3	[3]Principles of Economics Ec. 262	3
Structural Geology Geol. 354	3	Mineralogy Geol. 355	4	Petrology Geol. 356	4
Mining Methods Mn.E. 301	2	Mining Methods Mn.E. 302	2	Metal Fabrication M.E. 204	2
Mn.E. Laboratory Mn.E. 321	2	Mn E. Laboratory Mn.E. 322	2	Mining Methods Mn.E. 303	2
Elements of Mn. E. Mn.E 361	3	Elements of Mn. E. Mn.E. 362	3	Mn. E. Laboratory Mn.E. 323	2
Mechanics of Materials T.&A.M. 324	5	Dynamics of Engineering T.&A.M. 344	4	Mine Surveying Mn.E. 324	4
				Materials Laboratory T.&A.M. 327	1
	18		18		18

[1]May be taken only by students appointed to N.R.O.T.C.
[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T C.
[3]R.O.T.C. and N.R.O.T.C. students should take Ec. 261 in place of Ec. 262.

Senior Year

Economic Geology Geol. 434	4	D.C. Circuits & Machines E.E. 435	4	Accounting I Ec. 384A	3
[2]American Government Govt. 315B	3	Economic Geology Geol. 455	4	A.C. Circuits & Machines E.E. 437	4
Mineral Dressing Mn.E. 431	4	Mineral Dressing Mn.E. 432	4	Engineering Valuation Gen.E. 407	3
Mn. E. Design Mn E. 471	3	Mn. E. Design Mn.E. 472	3	[2]Prin. of Metallurgy Mn.E. 314	3
Speech-Making Speech 311	3	[2]Non-technical Electives	3	Fire Assaying Mn.E. 417	3
				Mn. E. Design Mn.E. 473	2
	17		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, Chem.E. 401, 402, 403; and Senior Inspection Trip, Mn.E. 400 (Fall).

[2]May be omitted by students appointed to R.O.T.C or N R O T.C.
All electives must be approved in advance by the head of the department.

Division of Home Economics

P. Mabel Nelson, Ph.D., Dean of Division of Home Economics
Paulena Nickell, Ph.D., Associate Dean
Home Economics Hall, Room 122

The Division of Home Economics consists of the Departments of Applied Art, Child Development, Foods and Nutrition, Home Economics Education, Home Management, Household Equipment, Institution Management, Physical Education for Women, and Textiles and Clothing.

Personnel Service. The division, through its placement office, endeavors to find positions for all its graduates who are trained for professional work. The general Home Economics curriculum does not prepare for professional placement. The service is also extended to undergraduates needing employment through summer vacations and to alumnae who wish to make changes in positions. Home economics graduates of the professional curricula of the Iowa State College are in demand as state supervisors, teachers of secondary schools and colleges, specialists in extension service, home demonstration agents, dietitians, food service directors, home service directors for public utility companies, research workers, technicians in commercial laboratories, workers in retail clothing and house furnishing departments, and members of editorial staffs of magazines and newspapers.

Honor Fraternities. There are two national home economics honor societies that have chapters at the Iowa State College—Omicron Nu and Phi Upsilon Omicron. A chapter of Delta Phi Delta, a professional society in the field of applied art, selects its membership from the applied art majors. Among other honor or professional societies open to students of home economics are:

Iota Sigma Pi	Chemistry	Women
Theta Sigma Phi	Journalism	Women
Sigma Alpha Iota	Music	Women
Psi Chi	Psychology	Men and Women
Sigma Delta Epsilon	Science	Women
Sigma Xi	All College	Men and Women
Mortar Board	All College	Women
Phi Kappa Phi	All College	Men and Women

The Home Economics Club. This club, to which all students of the division are eligible, furnishes a forum for the discussion of subjects of general interest in home economics. It arranges for lectures by speakers of national reputation. It assumes major responsibility for the Open House, which is an important feature of Veishea. The club maintains the Catherine MacKay loan fund and sends delegates to the annual convention of the American Home Economics Association.

Awards. Students in the Division of Home Economics are eligible for special awards as follows:

The Borden Home Economics Scholarship Award. This award of $300 will be presented during the fall quarter to that eligible student in the Division of Home

Curriculum in Mining Engineering

Leading to the degree of Bachelor of Science.

For freshman year, see page 114.

Sophomore Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Quantitative Analysis Chem. 211	4	Quantitative Analysis Chem. 212	4	General Geology Geol. 203	4
Diff. & Int. Calculus II Math. 212	4	General Geology Geol. 202	4	Industrial Stoichiometry Mn.E. 304	3
General Physics Phys. 221	5	Diff. & Int. Calculus III Math. 213	4	General Physics Phys. 223	5
Military Science	1	General Physics Phys. 222	5	Statics of Engineering T.&A.M. 274	4
or		Military Science	1	Military Science	1
[1]Naval Science N.S. 211	3	or		or	
Non-technical Elective	3	[1]Naval Science N.S. 212	3	[1]Naval Science N.S. 213	3
				Non-technical Electives	3
	17 or 19		18 or 20		20 or 22

In addition to the courses listed above, each student will be required to include in his schedule: Phys.Ed. 201, 202, 203.

Field trip or summer mine practice, 170 hours.

Junior Year

Plane Surveying C.E. 325	3	[2]Principles of Economics Ec. 261	3	[3]Principles of Economics Ec. 262	3
Structural Geology Geol. 354	3	Mineralogy Geol. 355	4	Petrology Geol. 356	4
Mining Methods Mn.E. 301	2	Mining Methods Mn.E. 302	2	Metal Fabrication M.E. 204	2
Mn.E. Laboratory Mn.E. 321	2	Mn. E. Laboratory Mn.E. 322	2	Mining Methods Mn.E. 303	2
Elements of Mn. E. Mn.E 361	3	Elements of Mn. E. Mn.E. 362	3	Mn. E. Laboratory Mn.E. 323	2
Mechanics of Materials T.&A.M. 324	5	Dynamics of Engineering T.&A.M. 344	4	Mine Surveying Mn.E. 324	4
				Materials Laboratory T.&A.M. 327	1
	18		18		18

[1]May be taken only by students appointed to N.R.O.T.C.
[2]May be omitted by students appointed to R.O.T.C. or N.R.O.T.C.
[3]R.O.T.C. and N.R.O.T.C. students should take Ec. 261 in place of Ec. 262.

Senior Year

Economic Geology Geol. 434	4	D.C. Circuits & Machines E.E. 435	4	Accounting I Ec. 384A	3
[2]American Government Govt. 315B	3	Economic Geology Geol. 455	4	A.C. Circuits & Machines E.E. 437	4
Mineral Dressing Mn.E. 431	4	Mineral Dressing Mn.E. 432	4	Engineering Valuation Gen.E. 407	3
Mn. E. Design Mn E. 471	3	Mn. E. Design Mn.E. 472	3	[2]Prin. of Metallurgy Mn.E. 314	3
Speech-Making Speech 311	3	[2]Non-technical Electives	3	Fire Assaying Mn.E. 417	3
				Mn. E. Design Mn.E. 473	2
	17		18		18

In addition to the courses listed above, each student will be required to include in his schedule: Seminar, Chem.E. 401, 402, 403; and Senior Inspection Trip, Mn.E. 400 (Fall).

[2]May be omitted by students appointed to R.O.T.C or N R O.T.C.
All electives must be approved in advance by the head of the department.

Division of Home Economics

P. MABEL NELSON, Ph.D., Dean of Division of Home Economics
PAULENA NICKELL, Ph.D., Associate Dean
Home Economics Hall, Room 122

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HONOR FRATERNITIES. There are two national home economics honor societies that have chapters at the Iowa State College—Omicron Nu and Phi Upsilon Omicron. A chapter of Delta Phi Delta, a professional society in the field of applied art, selects its membership from the applied art majors. Among other honor or professional societies open to students of home economics are:

Iota Sigma Pi	Chemistry	Women
Theta Sigma Phi	Journalism	Women
Sigma Alpha Iota	Music	Women
Psi Chi	Psychology	Men and Women
Sigma Delta Epsilon	Science	Women
Sigma Xi	All College	Men and Women
Mortar Board	All College	Women
Phi Kappa Phi	All College	Men and Women

THE HOME ECONOMICS CLUB. This club, to which all students of the division are eligible, furnishes a forum for the discussion of subjects of general interest in home economics. It arranges for lectures by speakers of national reputation. It assumes major responsibility for the Open House, which is an important feature of Veishea. The club maintains the Catherine MacKay loan fund and sends delegates to the annual convention of the American Home Economics Association.

AWARDS. Students in the Division of Home Economics are eligible for special awards as follows:

THE BORDEN HOME ECONOMICS SCHOLARSHIP AWARD. This award of $300 will be presented during the fall quarter to that eligible student in the Division of Home

Economics who is a first quarter senior during the fall quarter and has achieved the highest average grade of all other similarly eligible students in all preceding college work. Those students will be eligible for the award who have included in their curricula two or more courses in foods.

DELTA PHI DELTA AWARD. This is a gift to the junior student in Applied Art who has contributed the most toward the promotion of art during her three years on the campus. Selection of the recipient is made by the senior members of the Delta Phi Delta organization.

HOME ECONOMICS CLUB SCHOLARSHIP AWARD: Two scholarships of $50 each are awarded to junior Home Economics Club members who have worked approximately 15 hours a week for at least a year, have scholastic averages of at least "C" and have been outstanding in Home Economics Club work. They are to be used by the recipients the quarter of their choice during the senior year to provide time for campus professional activities.

ANNA LARRABEE PRIZE. This is awarded to the outstanding senior student in Cookery. The student's name is engraved on a silver tray, the property of the Home Economics Division, which is used for divisional social functions.

JOHN MORRELL SCHOLARSHIP FUND. This consists of $250 and is awarded to a 4-H girl selected by the Extension Service for 4-H Club records done before entering college.

MARY F. RAUSCH SCHOLARSHIP AWARD. This has been an award of $15 or $20 per year provided by earnings from money given by the sister of Mary F. Rausch as a memorial. The junior recipient is selected on the basis of scholarship, leadership, and initiative.

WNAX HOME ECONOMICS SCHOLARSHIP. The WNAX Broadcasting Company annually provides a $300 scholarship to be awarded to a girl from a farm home who has completed her freshman year in the Division of Home Economics. The selection of the recipient is based on outstanding scholarship, promise of leadership, character and financial need.

LOAN FUNDS. Worthy students of the senior college may secure financial assistance through several loan funds including the Catherine MacKay, the Frances Sheldon, the Hattie Miller Newens and the Julia McCulloch Smith Memorial Funds.

THE IOWA HOMEMAKER. A monthly magazine, *The Iowa Homemaker,* is published by the students of the division interested in preparing for editorial work in the field of home economics.

Curricula in Home Economics

The various curricula in the Home Economics division are planned on the basic assumption that a college education for women should provide for well-rounded personal development, for preparation to carry the responsibilities of homemaking and citizenship and for a professional career. The emphasis during the first two years is upon the general education of the student and upon education for family life. With this emphasis in mind the Uniform Freshman Year is designed to help orient students to college life and to begin their general education and preparation for homemaking. In the sophomore year general education is continued with considerable opportunity for individual choice of courses in

three areas, namely, home economics, humanities and social science, and physical or biological science.

The curricula offered by the division are: general home economics; applied art; child development; foods and nutrition with a major in dietetics, experimental cookery, nutrition in public health and welfare, or related science; home economics with a major in technical journalism, home economics education, home economics extension, home management, household equipment or household equipment and related science; institution management; textiles and clothing or textiles and related science.

For information regarding Home Economics Extension, see page 341.

The Core Curriculum

The general education of students in the Home Economics division is provided by a group of required courses known as the core curriculum and by freedom to elect courses of a general nature. The core curriculum has three major objectives, namely, the (1) development of the student as a person, (2) preparation for family life, (3) preparation for the responsibilities of citizenship in its broadest sense.

The courses in the core curriculum are required of all students in the Home Economics division except those who choose related science combined with foods and nutrition, household equipment, or textiles. See pages 135 to 137 for these curricula.

HOME ECONOMICS ..... 54 Credits

1. Applied Art ..... 12 Credits
   - A.A. 103, Basic Design — 4 Credits
   - A A. 260, House Planning — 2 "
   - A.A. 264, Basic Interior House Design — 3 "
   - A.A. 484, Survey of Art — 3 "
2. Child Development ..... 6 Credits
   - C.D. 235, Children in the Home — 3 Credits
   - C.D. 300, Introduction to Family Relationships — 3 "
3. Foods and Nutrition ..... 14 Credits
   - F.&N. 107, Introduction to Foods and Nutrition — 3 Credits
   - F.&N. 204, 205, Food Preparation — 8 "
   - F.&N. 303, Meal Planning — 3 "
4. Home Economics ..... 2 Credits
   - H.Ec. 105, Personal Adjustment for Professional Home Economics
5. Home Management ..... 7 Credits
   - H.Mgt. 474, General Home Management — 3 Credits
   - H.Mgt. 475, Home Management House — 4 "
6. Household Equipment ..... 3 Credits
   - H.Eq. 154, Fundamentals of Household Equipment
7. Textiles and Clothing ..... 10 Credits
   - T.&C. 145, Costume Design and Selection — 4 Credits
   - T.&C. 204, General Textiles — 3 "
   - T.&C. 224, Elementary Clothing Construction — 3 "

HUMANITIES AND SOCIAL SCIENCES ..... 41 Credits

1. Communication Skills ..... 12 Credits
   - Engl. 101, 102, 103, Principles of Composition — 9 Credits
   - Sp. 311, Speech-Making — 3 "
2. English Elective ..... 3 Credits
3. Social Sciences ..... 26 Credits
   - Ec. 211, 212, Principles of Economics — 6 Credits
   - Govt. 315A, American Government — 3 "
   - Hist. 212, 213, European and American Civilization — 6 "
   - Psych. 215, Developmental Psychology — 5 "
   - Soc. 234C, Introduction to Sociology — 3 "
   - Option — 3 "

PHYSICAL AND BIOLOGICAL SCIENCES ..... 24-27 Credits

1. Physical Sciences ..... 16-17 Credits
   - Chem. 105, 106, General Chemistry — 8 Credits
   - Chem. 264, Organic Chemistry — 4-5 "
   - Phys. 106, Physics for Home Economics Students — 4 "
2. Biological Sciences ..... 8-10 Credits
   - Bact. 200, or 304A or B, General Bacteriology — 3-5 Credits
   - Zool. 155, Physiology for Home Economics students — 5 "

PHYSICAL EDUCATION ..... 2 Credits

TOTAL 121-124 Credits

Uniform Freshman Year

HOME ECONOMICS ..... 13-16 Credits

1. Applied Art ..... 4 Credits
   - A.A. 103, Basic Design
2. Foods and Nutrition ..... 3 Credits
   - F.&N. 107, Introduction to Foods and Nutrition
3. Home Economics ..... 2 Credits
   - H.Ec. 105, Personal Adjustment for Professional Home Economics
4. Household Equipment ..... 3 Credits
   - H.Eq. 154, Fundamentals of Household Equipment
5. Textiles and Clothing ..... 4 Credits
   - T.&C. 145, Costume Design and Selection

HUMANITIES AND SOCIAL SCIENCES ..... 17 Credits

1. Communication Skills ..... 9 Credits
   - Engl. 101, 102, 103, Principles of Composition
2. Social Sciences ..... 8 Credits
   - Psych. 215, Developmental Psychology — 5 Credits
   - Soc. 234C, Introduction to Sociology — 3 "

PHYSICAL AND BIOLOGICAL SCIENCES ..... 8-13 Credits

1. Physical Sciences ..... 12 Credits
   - *Chem. 105, 106, General Chemistry — 8 Credits
   - Phys. 106, Physics for Home Economics Students — 4 "
2. Biological Sciences ..... 5 Credits
   - Zool. 155, Physiology for Home Economics Students

PHYSICAL EDUCATION ..... 1 Credit
- P.E. 121, 122, 123, Physical Education

TOTAL 44-45 Credits

In addition to courses listed above, each student will be required to include in her schedule: Lib. 106B (Fall).

For two quarters each student should select at least one course from each of the groups: English, biological or physical science, social science, and home economics. In the third quarter register for H.Ec. 105, instead of social science.

*Chemistry may be taken in the freshman or sophomore year. The two quarters of chemistry should be taken consecutively. If chemistry is taken in the freshman year, Physics 106 and Household Equipment 154 will be taken in the sophomore year.

Sophomore Year

Except for those students who have decided upon their field of specialization by the beginning of the sophomore year, a general curriculum is outlined. Courses for the year may be selected by the student, upon consultation with her counselor, from the core curriculum and from elective courses to make a total of 49-50 credits.

Suggested choices from the core curriculum recommended for the sophomore year are as follows:

HOME ECONOMICS ..... 16-22 Credits

1. Applied Art ..... 5 Credits
   - A.A. 260, House Planning — 2 Credits
   - A.A. 264, Basic Interior House Design — 3 "
2. Child Development ..... 6 Credits
   - C.D. 235, Children in the Home — 3 Credits
   - C.D. 300, Introduction to Family Relationships — 3 "
3. Foods and Nutrition ..... 8 Credits
   - F.&N. 204, 205, Food Preparation

4. Household Equipment ..... 3 Credits
   H.Eq. 154, Fundamentals of Household Equipment
5. Textiles and Clothing ..... 6 Credits
   T.&C. 204, General Textiles 3 Credits
   T.&C. 224, Elementary Clothing Construction 3 "

HUMANITIES AND SOCIAL SCIENCES ..... 12-16 Credits

1. Communication Skills ..... 3 Credits
   Sp. 311, Speech-Making
2. Social Sciences ..... 15 Credits
   Ec. 211, 212, Principles of Economics 6 Credits
   Hist. 212, 213 European and American Civilization 6 "
   Option 3 "

PHYSICAL AND BIOLOGICAL SCIENCES ..... 19-22 Credits

1. *Biological Sciences ..... 3-5 Credits
   Bact. 200, General Bacteriology 3 Credits
   or
   Bact. 304A or B, General Bacteriology 5 "
2. Physical Sciences ..... 12-13 Credits
   **Chem. 105, 106, General Chemistry 8 Credits
   ***Chem. 264, Organic Chemistry 4-5 "
   Phys. 106, Physics for Home Economics Students 4 "

PHYSICAL EDUCATION ..... 1 Credit
P.E. 221, 222, 223, Physical Education

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*All students choosing majors in Foods and Nutrition, Technical Journalism with foods sequence, or Institution Management should schedule Bacteriology 304A or B, 5 credits.

**If Chemistry 105 and 106 were not scheduled in the freshman year they should usually be scheduled in the sophomore year.

***All majors in the Foods and Nutrition department require the 5 credit course in Chem. 264, also Chem. 265 and 275. Technical Journalism majors planning to take the food sequence should take Chem. 264 for 5 credits.

Students planning to select a major in the following should schedule in the sophomore year certain courses not listed above:

Major in Applied Art
Applied Art 231, 232, 233, 6 credits

Major in Household Equipment
Mathematics 200, 5 credits

Major in Technical Journalism and Home Economics
T.Jl. 221, 222, 8 credits; for household equipment sequence, Math. 200, 5 credits.

Major in Related Science with emphasis on Foods, Household Equipment, or Textiles
See outlined courses pages 135-137.

Major in Textiles and Clothing
A.A. 211, 212, 4 credits.

Courses numbered in the one hundreds and two hundreds should usually be scheduled before courses with higher numbers.

Curriculum in Applied Art

Leading to the degree of Bachelor of Science.

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

Junior and Senior Years

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS ..... 44 Credits

Applied Art ..... 37 Credits
A.A. 231, 232, 233, Drawing and Composition 6 Credits
A.A. 305, Advertising Design 2 "
A.A. 324, Life Drawing 2 "
A.A. 344, Constructive and Decorative Design 2 "
A.A. 345, Craft Design 2 "
A.A. 393, Sculptural Design 2 "
A.A. 434, Textile Design 3 "
A.A. 445, Advanced Constructive and Decorative Design 2 "
A.A. 464, Intermediate Interior House Design 3 "
A.A. 504, Seminar 1 "
A.A. 507, Design in Lettering 2 "
A.A. 524, Painting and Composition 2 "

A.A. 535, Advanced Textile Design 2 "
A.A. 546, Jewelry Design and Construction 2 "
A.A. 585, Mediaeval and Renaissance Art 2 "
A.A. 586, Modern and Contemporary Art 2 "
H.Ec. 400, Professional Relations ..... R
Textiles and Clothing ..... 7 Credits
T.&C. 324, Advanced Clothing 4 Credits
T.&C. 514, Historic Textiles 3 "
OTHER REQUIRED COURSES ..... 4 Credits
Engl. 205, Propaganda Analysis ..... } 3 Credits
or
T.Jl. 225B, Beginning Technical Journalism ..... }
Mus. 144, Music Appreciation ..... 1 "
ELECTIVES ..... 23 Credits

Curriculum in Child Development

Leading to the degree of Bachelor of Science.

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

Junior and Senior Years

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS ..... 33 Credits
Child Development ..... 29 Credits
C.D. 340, Literature for Children 3 Credits
C.D. 436, Development in Early Childhood 3 "
C.D. 440, Play and Play Materials in the Nursery School 3 "
C.D. 465, Seminar 2 "
C.D. 466, Methods of Nursery School Teaching 4 "
C.D. 467, Supervised Teaching in the Nursery School 5 "
C.D. 536, Development in Later Childhood 3 "
C.D. 546, Community Factors in Development of Children 3 "
C.D. 558, Nursery School Planning 3 "
F.&N. 405, Nutrition of the Child in the Family ..... 4 Credits
H.Ec. 400, Professional Relations ..... R
OTHER REQUIRED COURSES ..... 18 Credits
Chem. 274, Physiological and Nutritional Chemistry ..... 3 Credits
English Electives ..... 3 "
Psych. 516, Advanced Child Psychology ..... 3 "
Soc. 419, Dynamics of Family Development ..... 3 "
Zoology ..... 6 "
Zool. 458, Physiology of Reproduction 3 Credits
Zool. 526, Physical Growth of Children 3 "
ELECTIVES ..... 20 Credits

Curriculum in Foods and Nutrition

Leading to the degree of Bachelor of Science.

Major in Dietetics* .

Junior and Senior Years

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS ..... 31 Credits
Foods and Nutrition ..... 18 Credits
F.&N. 305, Nutrition and Dietetics 4 Credits
F.&N. 404, Seminar in Nutrition and Dietetics 2 "
F.&N. 504, Diet Therapy 3 "
F.&N. 506, Nutrition of Children 3 "
F.&N. 511, Experimental Cookery 3 "
F.&N. 518, Methods of Teaching Hospital Dietetics 3 "
H.Ec. 400, Professional Relations ..... R
H.Ed. 415, Principles of Education for Dietitians ..... 2 Credits
Institution Management ..... 11 "
I.Mgt. 380, Large Quantity Cookery 4 Credits
I.Mgt. 484, Purchasing 4 "
I.Mgt. 587, Organization and Management 3 "

*This major includes the courses required for membership in the American Dietetic Association and qualifies the student for an internship in a hospital or an institution approved by the Association.

OTHER REQUIRED COURSES ..... 20 Credits
- Chemistry ..... 10 Credits
  - Chem. 265, Food Analysis 5 Credits
  - Chem. 275, Physiological and Nutritional Chemistry 5 "
- Ec. 384B, Accounting I ..... 4 Credits
- T.Jl. 225B, Beginning Technical Journalism ..... } 3 "
  or
  Electives in English or Speech ..... }
- Zool. 458, Physiology of Reproduction ..... 3 "

ELECTIVES ..... 17 Credits

Major in Experimental Cookery

Junior and Senior Years

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS ..... 22 Credits
- Foods and Nutrition ..... 18 Credits
  - F.&N. 305, Nutrition and Dietetics 4 Credits
  - F.&N. 404, Seminar in Nutrition and Dietetics 2 "
  - F.&N. 506, Nutrition of Children 3 "
  - F.&N. 511, 512, 513, Experimental Cookery 9 "
- H.Ec. 400, Professional Relations ..... R
- I.Mgt. 380, Large Quantity Cookery ..... 4 Credits

OTHER REQUIRED COURSES ..... 31 Credits
- Chemistry ..... 13 Credits
  - Chem. 265, Food Analysis 5 Credits
  - Chem. 275, Physiological and Nutritional Chemistry 5 "
  - Chem. 425, Colloid Chemistry 3 "
- Sp. 303, Radio Speech ..... 3 Credits
- Technical Journalism ..... 6 "
  - T.Jl. 225B, Beginning Technical Journalism 3 Credits
  - T.Jl. 335, Feature Articles for Technical Journals 3 "
- Zool. 458, Physiology of Reproduction ..... 3 Credits
- Options* ..... 6 "

ELECTIVES ..... 15 Credits

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*Options—Elect 6 credits from the following:
Animal Husbandry 374
Bacteriology 501, 535
Household Equipment 421*
Institution Management 484, 580, 585
Physics 316
Technical Journalism 325, 475

*Advance registration required with head of department.

Major in Nutrition in Public Health and Welfare

This is a pre-professional major. Students who wish to qualify for a career in this field are advised to secure an advanced degree, preferably after a short period of work experience which might be taken in any one of several areas. By selecting a minor in sociology or by taking the education sequence, experience may be obtained in the field of social work or in teaching. By selecting institution management courses as electives, experience may be obtained as a dietitian.

Junior and Senior Years*

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS ..... 20 Credits

Foods and Nutrition ..... 18 Credits
- F.&N. 305, Nutrition and Dietetics — 4 Credits
- F.&N. 404, Seminar in Nutrition and Dietetics — 2 "
- F.&N. 504, Diet Therapy — 3 "
- F.&N. 506, Nutrition of Children — 3 "
- F.&N. 511, Experimental Cookery — 3 "
- F.&N. 514, Nutrition and Public Welfare — 3 "

H.Ec. 400, Professional Relations ..... R
H.Mgt. 418, Family Finance ..... 2 "

OTHER REQUIRED COURSES ..... 22 Credits

Chemistry ..... 10 Credits
- Chem. 265, Food Analysis — 5 Credits
- Chem. 275, Physiological and Nutritional Chemistry — 5 "

Sociology ..... 6 Credits
- Soc. 464, Community Organization — 3 Credits
- Soc. 485, Sociology of the Family / or / Soc. 419, Dynamics of Family Development — 3 "

T.Jl. 225B, Beginning Technical Journalism ..... 3 Credits
Zool. 458, Physiology of Reproduction ..... 3 "

ELECTIVES ..... 26 Credits

Because of the large number of electives in this curriculum, there are many opportunities for combining other fields of subject matter with nutrition in addition to those described. These should be carefully planned with the counselor.

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*For experience in social work the following courses are suggested to complete a minor in sociology:

Sociology ..... 9 Credits
- Soc. 404, Sociological Analysis — 3 Credits
- Soc. 460, Fields of Social Work / or / Soc. 490, Social Case Work — 3 "
- Soc. 588, Social Legislation and Policy — 3 "
- Soc. 405, Sociological Analysis, is recommended

For teaching Home Economics, preparation should include.

C D. 480, Guidance in Later Childhood ..... 3 Credits
Home Economics Education ..... 15 "
- H.Ed. 405, Observation of Teaching — 2 Credits
- H.Ed. 406, Methods of Teaching Home Economics — 2 "
- H.Ed. 407, Supervised Teaching in Home Economics — 5 "
- H Ed. 409, Planning and Evaluating the H.Ec. Program — 3 "
- H.Ed. 508, Adult Education in Homemaking — 3 "

Psychology ..... 6 "
- Psych. 334, Educational Psychology — 3 Credits
- Psych. 414, Psychology of the Adolescent — 3 "

T.&C. 324, Advanced Clothing ..... 4 "
Vocational Education ..... 9 "
- V Ed. 304, Principles of Education — 3 Credits
- V Ed. 305, Methods of Teaching — 3 "
- V.Ed. 426, Principles of Secondary Education — 3 "

TOTAL 37

For a dietitian

Institution Management ..... 11 Credits
- I.Mgt. 380, Large Quantity Cookery — 4 Credits
- I.Mgt. 484, Purchasing — 4 "
- I.Mgt. 587, Organization and Management — 3 "

Curriculum in General Home Economics

(Non-Professional)

Leading to the degree of Bachelor of Science.

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

The General Home Economics curriculum is designed for those students interested primarily in a non-professional education in home economics. It offers

a more general training to those who do not wish to specialize for professional placement. Freedom to choose courses of specific interest to the student is made possible by large blocks of options and free elective credits.

Within the options and free electives, the student should plan with her counselor at least 12 credits in relation to some major interest, such as, social and community problems, drama and creative expression, human behavior, philosophy and cultures, arts and crafts, literature, or modern languages. Counselors will have lists of suggested courses within interest areas.

Junior and Senior Years

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS		15 Credits
Child Development	6	Credits
C.D. 546[1], Development in Later Childhood	3	Credits
C.D. Option	3	"
H.Eq. 445, Equipment Selection and Use	3	"
H.Mgt. 415, Consumers in the Market	3	"
Option in any subject area of home economics	3	"
OTHER REQUIRED COURSES		18 Credits
English, Speech, or Technical Journalism courses	9	Credits
Social Science options	3	"
Science options	3	"
Zool. 458, Physiology of Reproduction	3	"
ELECTIVES		37 Credits

[1]Soc. 334 may be taken in place of C.D. 546

Curriculum in Home Economics and Related Science

Leading to the degree of Bachelor of Science.

This curriculum is planned for students who wish to emphasize science in relation to foods and nutrition, household equipment, or textiles. Students who have completed one of these majors have found interesting opportunities as laboratory or technical workers. These majors also provide an excellent background for graduate study basic to professional advancement in the specified fields. It should be noted that the freshman year, common to these three majors, is also similar to the freshman year of all other curricula in Home Economics.

Students are advised to consult the head of the department in which they wish to place major emphasis before planning their program of study.

Freshman Year

TOTAL CREDITS		44, 45, or 46
A.A. 103, Basic Design	4	Credits
Chemistry	12	"
Chem. 101, 102, General Chemistry or Chem 105, 106, General Chemistry	8	Credits
Chem. 103, General Chemistry and Qualitative Analysis	4	"
Engl. 101, 102, 103, Principles of Composition	9	"
F.&N. 107*, Introduction to Foods and Nutrition or Soc. 234C, Introduction to Sociology	3	"
H.Ec. 105, Personal Adjustment for Professional Home Economics	2	"
Libr. 106B, Library Instruction	R	
Psych. 215, Development Psychology	5	"
T.&C. 145*, Costume Design and Selection	4	"
or	or	
T.&C. 204***, General Textiles	3	"
Zool. 155**, Physiology for Home Economics Students	5	"
or	or	
Zool. 104, 105, General Biology	6	"
Physical Education	1	"

*To be taken by those who expect to major in Textiles and Related Science.

**To be taken by those who expect to major in Household Equipment and Related Science or in Textiles and Related Science.

***To be taken by those who expect to major in Foods and Nutrition and Related Science or in Household Equipment and Related Science.

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Major in Foods and Nutrition and Related Science

Administered by the Foods and Nutrition Department.

For freshman year, see page 135.

The following courses in addition to those in the freshman year are required.

Sophomore, Junior, and Senior Years

HOME ECONOMICS		29 Credits
A.A. 484, Survey of Art	3	Credits
C.D. 235, Children in the Home	3	"
Foods and Nutrition	23	"
F.&N. 204, 205, Food Preparation	8	Credits
F.&N. 303, Meal Planning	3	"
F.&N. 305, Nutrition and Dietetics	4	"
F.&N. 404, Seminar in Nutrition and Dietetics	2	"
F.&N. 511, 512, Experimental Cookery or F.&N. 511, Experimental Cookery—3 credits F.&N. 515, Introduction to Nutrition Res.—3 credits	6	"
H.Ec. 400, Professional Relations	R	
OTHER REQUIRED COURSES	108	Credits
Bact. 304A or B, General Bacteriology I	5	Credits
Chemistry	27	"
Chem. 211, 212, Quantitative Analysis	8	Credits
Chem. 330 (4 crs.), 331, 332, 333, Organic Chemistry	13	"
Chem. 425, Colloid Chemistry	3	"
Chem. 474, Physiological and Nutritional Chemistry	3	"
Ec. 211, 212, 213, Principles of Economics	9	"
English Literature or T.Jl. 225B, Beginning Technical Journalism	3	"
Govt. 315A, American Government	3	"
Hist. 212, 213, European and American Civilization since 1305	6	"
Mathematics	24	"
Math. 101, College Algebra	5	Credits
Math. 102A, Plane Trigonometry	5	"
Math. 103, Analytical Geometry	5	"
Math. 211, 212, Calculus (211, 5 crs.) (212, 4 crs.)	9	"
M.L. 441, 442, 443, Reading Knowledge of German or M.L. 231, 232, 233, Elementary German	9	"
Phys. 211, 212, 213, General Physics	12	"
Sp. 311, Speech-Making	3	"
Science Options*	6	"
Physical Education	1	"
ELECTIVES	10-11	Credits

*To be selected from one field such as Chem. 321, 322; Bact. 501, 535, or other course groups approved by counselor.

Major in Household Equipment and Related Science

Administered by the Household Equipment Department.

For freshman year, see page 135.

The following courses in addition to those in the freshman year are required.

Sophomore, Junior, and Senior Years

HOME ECONOMICS		43 Credits
A.A. 484, Survey of Art	3	Credits
C.D. 235, Children in the Home	3	"
Foods and Nutrition	14	"
F.&N. 204, 205, Food Preparation	8	Credits
F.&N. 511, 512, Experimental Cookery	6	"
H.Ec. 400, Professional Relations	R	
H.Mgt. 474, General Home Management	3	"
Household Equipment	20	"
H.Eq. 154, Fundamentals of Household Equipment	3	Credits
H.Eq. 404, 405, 406, Equipment Mechanics	9	"
H.Eq. 425, Seminar	2	"
H.Eq. 506, Gas and Electric Cooking Appliances	3	"
H.Eq. 509, Refrigeration and Home Lighting	3	"

OTHER REQUIRED COURSES		94-97 Credits
Bact. 304B, General Bacteriology I		5 Credits
Chemistry		13 "
Chem. 264, Organic Chemistry	5 Credits	
Chem. 265, Food Analysis	5 "	
Chem. 274, Physical and Nutritional Chemistry	3 "	
Ec. 211, 212, 213, Principles of Economics		9 "
Engl. 414, Writing of Scientific Papers		3 "
Govt. 315A, American Government		3 "
Hist. 212, 213, European and American Civilization since 1305		6 "
Mathematics		24 "
Math. 101, College Algebra	5 Credits	
Math. 102A, Plane Trigonometry	5 "	
Math. 103, Analytical Geometry	5 "	
Math. 211, Calculus	5 "	
Math. 212, Calculus	4 "	
Modern Language (French or German)		9 "
or		
Stat. 301, 302, Principles of Statistics		6 "
Physics		18 "
Phys. 211, 212, 213, General Physics	12 Credits	
Physics electives	6 "	
Sp. 311, Speech-Making		3 "
T.Jl. 225B, Beginning Technical Journalism		3 "
Physical Education		1 "
ELECTIVES		8-11 Credits

Major in Textiles and Related Science

Administered by the Textiles and Clothing Department.

For freshman year, see page 135.

The following courses in addition to those in the freshman year are required.

Sophomore, Junior, and Senior Years

HOME ECONOMICS		29 Credits
A.A. 484, Survey of Art		3 Credits
C.D. 235, Children in the Home		3 "
F.&N. 204, 205, Food Preparation		8 "
H.Ec. 400, Professional Relations		R
Textiles and Clothing		15 "
T.&C. 204, General Textiles	3 Credits	
T.&C. 224, Elementary Clothing Construction	3 "	
T.&C. 504, Advanced Textiles	3 "	
T.&C. 514, Historic Textiles	3 "	
T.&C. 554, History of Costume	3 "	
OTHER REQUIRED COURSES		109-111 Credits
Bact. 304A or B, General Bacteriology		5 Credits
Chemistry		36 or 34 "
Chem. 211, 212, Quantitative Analysis	8 Credits	
Chem. 268, Textile Chemistry	5 "	
Chem. 331, 332, Organic Chemistry	6 "	
Chem. 466, Textile Chemistry	4 "	
Chem. 474, Physiological and Nutritional Chemistry	5 "	
Chem. 321, 322, Physical Chemistry	8 "	
or	or	
Stat. 301, 302, Principles of Statistics	6 "	
Ec. 211, 212, 213, Principles of Economics		9 "
Govt. 315A, American Government		3 "
Hist. 212, 213, European and American Civilization		6 "
Mathematics		24 "
Math. 101, College Algebra	5 Credits	
Math. 102A, Plane Trigonometry	5 "	
Math. 103, Analytical Geometry	5 "	
Math. 211, Differential and Integral Calculus I	5 "	
Math. 212, Differential and Integral Calculus II	4 "	
M.L. 441, 442, 443, Reading Knowledge of German		9 "
Phys. 211, 212, 213, General Physics		12 "
Soc. 234C, Introduction to Sociology		3 "
Sp. 311, Speech-Making		3 "
Physical Education		1 "
ELECTIVES		6-9 Credits

Curriculum in Home Economics With Major in Technical Journalism

Administered by the Dean of the Division of Home Economics with Ellen Pennell, Assistant Professor of Technical Journalism, as Senior College Counselor.

Leading to the degree of Bachelor of Science.

A variety of positions is open to women with combined training in home economics and technical journalism. Such positions include editorial, advertising, radio and television work on media associated with home economics.

Students in home economics with a major in technical journalism have opportunities for practical experience through work on campus publications including *The Iowa Homemaker,* published by home economics students. Many young women also lay a foundation for active careers by contributing to magazines and newspapers during their training.

Junior and Senior Years

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS		15 Credits
A total of 15 credits beyond the subjects required in the core curriculum shall be taken in one subject area of home economics, chosen upon consultation with the senior college counselor.		
H.Ec. 400, Professional Relations	R	
PROFESSIONAL JOURNALISM COURSES		34 Credits
Technical Journalism	24 Credits	
*T.Jl. 221, 222, Technical Writing	8 Credits	
T.Jl. 342, 343, Practice in Copy Editing and Typography	4 "	
T.Jl. 426, 427, Technical Writing	6 "	
T.Jl. 445, Technical Advertising	3 "	
T.Jl. 475, Radio Writing	3 "	
Options	10 "	
ELECTIVES		19-22 Credits

*These courses should be taken in the sophomore year.

Curriculum in Home Economics Education

Leading to the degree of Bachelor of Science.

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

Junior and Senior Years

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS		11 Credits
C.D. 480, Guidance in Later Childhood	3 Credits	
F.&N. 305, Nutrition and Dietetics	4 "	
H.Ec. 400, Professional Relations	R	
T.&C. 324, Advanced Clothing	4 "	
EDUCATION		24 Credits
H.Ed. 405, Observation of Teaching	2 Credits	
H.Ed. 406, Methods of Teaching Home Economics	2 "	
[1]H.Ed. 407, Supervised Teaching in Home Economics	5 "	
H.Ed. 409, Planning and Evaluating the Home Economics Program or [2]V.Ed. 467, Methods of Extension Education	3 "	

[1]Opportunities for supervised teaching in home economics are offered in typical Iowa schools. The teaching may be had over the full quarter or concentrated into half of the quarter, the other half being devoted to home management. Reservation should be filed with the head of the department at least three quarters before teaching.

[2]For preparation for the Extension Service, V.Ed. 467.

H.Ed. 508, Adult Education in Homemaking	3	"
V.Ed. 304, Principles of Education	3	"
V.Ed. 305, Methods of Teaching	3	"
*V.Ed. 426, Principles of Secondary Education	3	"
OTHER REQUIRED COURSES	15	Credits
Chem. 274, Physical and Nutritional Chemistry	3	Credits
English, Speech or Technical Journalism option	3	"
Psychology	6	"
Psych. 334, Educational Psychology	3 Credits	
Psych. 414, Psychology of the Adolescent	3 "	
Soc. 419, Dynamics of Family Development	3	"
ELECTIVES	20	Credits
TOTAL	70	Credits

*Offered in six weeks' sections and paralleling H.Mgt. 474 and 475, or in full quarter sections.

Curriculum in Home Management

Leading to the degree of Bachelor of Science.

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

Junior and Senior Years

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS	23	Credits
Child Development	3	Credits
Option	3 Credits	
F.&N. 405, Nutrition of the Child in the Family	4	"
H.Ec. 400, Professional Relations	R	
Home Management	11	"
H.Mgt. 415, Consumers in the Market	3 Credits	
H.Mgt. 418, Family Finance	2 "	
H.Mgt. 514, Economics of the Household	3 "	
H.Mgt. 517, Economics of Housing	3 "	
H.Eq. 445, Equipment Selection and Use	3	"
T.&C. 464, Textile Purchasing	2	"
OTHER REQUIRED COURSES	21	Credits
Chem. 274, Physiological and Nutritional Chemistry	3	Credits
Ec. 304, Money and Banking	3	"
Engl. 484, The Literature of Family Life	3	"
Sociology	9	"
Soc. 334, Social Problems	3 Credits	
Soc. 409, Comparative Cultures: Introd. to Social Anthrp.	3 "	
Soc. 419, Dynamics of Family Development	3 "	
Social Science option	3	"
Zool. 458, Physiology of Reproduction	3	"
ELECTIVES	24	Credits

Curriculum in Household Equipment

Leading to the degree of Bachelor of Science.

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

Junior and Senior Years

The following courses are required in addition to those in the core curriculum, for a major in household equipment and home service.

HOME ECONOMICS	33 or 34	Credits
Foods and Nutrition	10 or 11	Credits
F.&N. 305, Nutrition and Dietetics	4 Credits	
F.&N. 511, 512, Experimental Cookery	6 "	
or	or	
F.&N. 511, Experimental Cookery—3 crs. / I.Mgt. 380, Large Quantity Cookery—4 crs.	7 "	
H.Ec. 400, Professional Relations	R	
Household Equipment	23	"

H.Eq. 404, 405, 406, Equipment Mechanics	9	Credits
H.Eq. 421A, Training in Demonstration Techniques	3	"
H.Eq. 422, Home Service Organization and Management	3	"
H.Eq. 425, Seminar	2	"
H.Eq. 506, Gas and Electric Cooking Appliances	3	"
H.Eq. 509, Refrigeration and Home Lighting	3	"
OTHER REQUIRED COURSES	20	Credits
Chem. 274, Physiological and Nutritional Chemistry	3	Credits
Engl. 414, Writing of Scientific Papers	3	"
Math. 200, General Mathematics for Students of Home Economics	5	"
Sp. 302, Radio Speech	3	"
Technical Journalism	6	"
T.Jl. 225B, Beginning Technical Journalism	3	Credits
T.Jl. 475, Radio Writing	3	"
ELECTIVES	16 or 17	Credits

The following courses are required in addition to those in the core curriculum, for a major in household equipment and equipment testing.

HOME ECONOMICS	27	Credits
Foods and Nutrition	7	Credits
F.&N. 305, Nutrition and Dietetics	4	Credits
F.&N. 511, Experimental Cookery	3	"
H.Ec. 400, Professional Relations	R	
Household Equipment	20	"
H.Eq. 404, 405, 406, Equipment Mechanics	9	Credits
H.Eq. 421A, Training in Demonstration Techniques	3	"
H.Eq. 425, Seminar	2	"
H.Eq. 506, Gas and Electric Cooking Appliances	3	"
H.Eq. 509, Refrigeration and Home Lighting	3	"
OTHER REQUIRED COURSES	26	Credits
Chem. 274, Physiological and Nutritional Chemistry	3	Credits
Engl. 414, Writing of Scientific Papers	3	"
Math. 200, General Mathematics for Students of Home Economics	5	"
Phys. 211, 212, 213, General Physics	12	"
T.Jl. 225B, Beginning Technical Journalism	3	"
ELECTIVES	17	Credits

Curriculum in Institution Management

Leading to the degree of Bachelor of Science.

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

Junior and Senior Years

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS	32	Credits
Foods and Nutrition	10	Credits
F.&N. 305, Nutrition and Dietetics	4	Credits
F.&N. 504, Diet Therapy	3	"
[1]F.&N. 511, Experimental Cookery	3	"
H.Ec. 400, Professional Relations	R	
Institution Management	22	"
[1]I.Mgt. 380, Large Quantity Cookery	4	Credits
I.Mgt. 484, Purchasing	4	"
I.Mgt. 485, Equipment	4	"
I.Mgt. 585, Catering	4	"
I.Mgt. 586, Institution Management Experience	3	"
I.Mgt. 587, Organization and Management	3	"
OTHER REQUIRED COURSES	12	Credits
Chemistry	8	Credits
Chem. 265, Food Analysis	5	Credits
Chem. 274, Physiological and Nutritional Chemistry	3	"
Ec. 384B, Accounting I	4	"
ELECTIVES[2]	25	Credits

[1]Advance reservation required.

[2]Recommended electives:

V.Ed. 304 and 305, or equivalent, for students interested in meeting the academic requirements for the American Dietetic Association.

A.H. 374; Ec. 305, 365; Hort. 146; H.Eq. 421B; Psych. 464; T.Jl. 225B for students who plan to engage in commercial food service.

A.H. 374; Ec. 305, 365; Hort. 146; I.Mgt. 589; Psych. 464 for students interested in the management of college residence halls.

Curriculum in Textiles and Clothing

Leading to the degree of Bachelor of Science.

For freshman year, see page 130; for sophomore year, see page 130; for core curriculum, see page 129.

Junior and Senior Years

The following courses are required in addition to those in the core curriculum.

HOME ECONOMICS		30 Credits
Applied Art	7 Credits	
*A.A. 211, 212, Freehand Drawing and Painting	4 Credits	
A.A 434, Textile Design	3 "	
H.Ec. 400, Professional Relations	R	
Textiles and Clothing	23 "	
T.&C. 324, Advanced Clothing	4 Credits	
T.&C. 444, Costume Design	3 "	
T.&C. 464, Textile Purchasing	2 "	
T.&C. 504, Advanced Textiles	3 "	
T.&C. 514, Historic Textiles	3 "	
T.&C. 524, Applied Dress Design	3 "	
T.&C. 554, History of Costume	3 "	
T.&C. 565, Producing and Distributing Units of Textile Commodities	2 "	
OTHER REQUIRED COURSES		11 Credits
**Chem. 268, Textile Chemistry	5 Credits	
English	6 "	
Engl. 254, Introduction to American Literature	3 Credits	
Engl. 304, Advanced Composition or T.Jl. 225B, Beginning Technical Journalism	3 "	
ELECTIVES		30 Credits

*These courses should be taken in the sophomore year as a rule.
**Whenever possible schedule this course in the sophomore year.

Division of Science

HAROLD V. GASKILL, Ph.D., Dean of Division of Science
J. A. GREENLEE, Ph.D., Assistant to the Dean
Beardshear Hall, Room 111

The Division of Science includes the following departments of instruction: Bacteriology, Botany, Chemistry, Economics and Sociology, English and Speech, Geology, History and Government, Hygiene, Library, Mathematics, Military Science, Naval Science, Air Science and Tactics, Modern Languages, Music, Physical Education for Men, Physics, Psychology, Religious Education, Statistics, Zoology and Entomology. The faculty of the division is made up of the following:

1. Members of all departments within the division.
2. Members of the Departments of Veterinary Anatomy, Veterinary Pathology, and Veterinary Physiology, administered in the Division of Veterinary Medicine.
3. Designated representatives from other divisions.

PERSONNEL SERVICE. Through its Personnel Office the Division of Science keeps in close contact with those industries, commercial organizations, and other fields of activity that require the services of young men and women trained in the sciences, and assists students in securing positions. This service is available to the members of each graduating class, and to graduates of earlier years who desire to enter new lines of work. The Teacher Placement Service maintained by the College is also available.

OPPORTUNITIES FOR GRADUATES IN SCIENCE. The remarkable development of the sciences in the last half-century, and the extensive applications of these sciences to present day industry and commerce, and to the economic and social aspects of modern life, have resulted in an increasing demand for scientists and technicians in industry, and for teachers and investigators of science.

HONORS AND HONOR SOCIETIES. Scholarship holds a high place in the Iowa State College, and appropriate honors are bestowed upon students whose academic records are outstanding. In addition to prizes and letters, there are many honor organizations for admission to which high scholarship is a prerequisite. These campus societies are listed in the "Official Rules of the College."

THE SCIENCE COUNCIL is the governing body of the student organizations and activities in the Division of Science. The members of the Council collect and summarize student opinion concerning educational objectives and methods; the Council sponsors activities designed to promote closer acquaintance among faculty members and students and to develop a spirit of loyalty to the Division.

THE SCIENCE WOMEN'S CLUB provides opportunity, through its monthly meetings, for the consideration of matters of common intellectual interest, and sponsors the social activities of the women students in the Division of Science.

THE IOWA STATE SCIENTIST, under the supervision of a Publications Board composed of both students and faculty representatives, brings to its readers news about the Science Division—its educational plans and purposes, its research program, and its faculty and students.

Curriculum in Science

Leading to the degree of Bachelor of Science.

The curriculum in Science is designed so that the student may secure an adequate background in the sciences and general studies. It allows considerable latitude for personal choice. During the first two years, while in junior college, the student is expected to work in several fields of learning in order to discover his individual aptitudes and to lay a broad foundation for later specialization.

Group Requirements

As a prerequisite to graduation, to insure breadth of educational experience, each student must complete *at some time during the four years* a minimum of 15 credits in each of the seven groups named below:

(1) Written and spoken English
(2) Mathematics; statistics (Wherever the semicolon appears in this list it means "and/or".)
(3) Chemistry; physics; geology
(4) Botany; zoology; bacteriology; genetics
(5) Economics; sociology; psychology; government
(6) History; literature
(7) Modern language

As a condition for promotion to the senior college, the student must have completed at least 51 credits in five of the seven groups named above. (For other conditions, see the "Official Rules of the College".)

General Requirements

(1) Total credits for graduation, 192, exclusive of these courses:
  (a) For men, six additional credits in Military or Air Science and six quarters of Physical Education (without credit).
  (b) For women, two additional credits in Physical Education.
  (c) Library 106D.
(2) Science Orientation (Science 100) in the freshman year.
(3) Government 315 (may be included as part of the requirement in Group 5).
(4) One *major,* minimum of 30 credits, and two *minors,* totaling 30 credits, related to each student's basic educational objectives, each exclusive of the Group Requirements.

The student will plan his program as follows:

Freshman Year

The freshman year will include 48 credits. During this year, the student must complete 9 credits in written English (Group 1) and at least 12 credits in mathematics (Group 2). In addition, 24 to 27 credits will be chosen from courses offered by departments in Groups 3, 4, or 5, with *more than one group* represented. Students in Naval Science may postpone completion of group requirements equivalent in credits to the required work in Naval Science. Normally, the freshman program will not include courses in Group 6 or Group 7.

Sophomore Year

The sophomore year will include 48 credits. If only four of the seven groups were represented in the freshman year, the sophomore program must include courses in a fifth group (minimum of 3 credits). During the sophomore year the student may experiment further with the basic fields of learning, in order to discover

aptitudes and interests, or may elect courses in a field already chosen, including related work suggested by the major department. Normally, the student should know by the third quarter of the sophomore year what his senior college major will be.

Junior and Senior Years

The requirements in the senior college are

(1) the completion of whatever group requirements remain after the freshman and sophomore years

(2) the completion of the major and two minors (defined under "General Requirements")

(3) elective courses

Upon promotion to senior college, each student must work out a complete program of courses for the junior and senior years in conference with the head of the major department or his representative The total program for the four years will contain a minimum of 192 credits, exclusive of required Military or Air Science and Physical Education. Each program must be approved by the Dean of Science.

A major consisting of at least 30 credits may be chosen from one of the following fields:

BACTERIOLOGY: General and systematic; dairy; soil; veterinary; pathogenic; food; sanitary; household; physiological and fermentation.

BOTANY: Ecology; morphology; mycology; pathology; physiology; systematic; preparation for applied botanical science; economic botany, plant protection, seed technology.

CHEMISTRY: Analytical; bio-organic; bio-physical; enzyme; food and sanitary; inorganic and qualitative analysis; organic; physical; plant; physiological and nutritional; soil; textile; chemical technology.

CLIMATOLOGY AND METEOROLOGY: Individual programs with major in physics, geology, or some other field. Minor programs in engineering or agriculture in connection with appropriate majors.

ECONOMICS OR SOCIOLOGY: Agricultural economics; consumption economics; general economics; general sociology; rural sociology.

FOOD TECHNOLOGY: Individual programs planned with emphasis on the phase of the field of special interest to the student. For suggested elements in the program, see the curriculum in chemical technology, page 146. Freshmen should elect Zool. 104, 105 and Bot. 101C. For sophomores, social science electives should replace Chem. 201, 202. Three months of practical experience, approved by the Administrative Committee, in a branch of the food industry of particular interest to the student is required before graduation. This program requires a sequence in mathematics, physics and chemistry essential for graduate work in food technology.

GENERAL SCIENCE: See page 145.

GENETICS: Heredity in relation to the improvement of animals and plants

GEOLOGY: Economic; agricultural; general.

HISTORY OR GOVERNMENT: Economic history and government.

INDUSTRIAL ECONOMICS: Financial organization and techniques of financial administration; marketing structure and functions; legal framework of business organizations and business operations; industrial relations; managerial accounting and cost accounting; preparation for the study of Law by completion of three years of this curriculum, followed by one year in a recognized law college after which the degree of Bachelor of Science will be awarded by the Iowa State College.

INDUSTRIAL PSYCHOLOGY.

MATHEMATICS: Applied (mechanics and physical); statistics; analysis and geometry.

NAVAL SCIENCE: Courses in naval science to meet requirements of the Navy Department.

PHYSICAL EDUCATION: For men, in combination with a minor in another science. Individual programs in physical education are planned for the student by the head of the department with the approval of the dean.

PHYSICS: Applied; general; mathematical; bio-physics.

STATISTICS: Statistical methods in biology, economics, and education; mathematical statistics.

TECHNICAL JOURNALISM: Reporting; editing; management of newspapers and technical journals; advertising; radio journalism; outdoor writing.

ZOOLOGY: Economic zoology; entomology; cytology; embryology and histology; parasitology; physiology; protozoology; wildlife conservation; apiculture.

The two minors, totaling 30 credits, should be related to the student's basic educational objectives and should be composed of courses ordinarily of senior college rank. These minors may be chosen from the list of fields which appears above, or from the following: Air Science, English, Military Science, Modern Languages, Physical Education for Women, Radio Broadcasting, Religious Education, Speech, or courses in other divisions. If justified by the student's vocational objective, a minor may include closely related courses offered by more than one department.

General Science

Students who do not wish to declare a departmental major, but desire a broader training in Science, may select at the beginning of their junior year the major in General Science. The academic program to be worked out in conferences and to be approved by the Dean of Science must include:

(1) Four related fields of study; each field to consist of from nine to twenty-one credits to total sixty credits. All of these courses must be based on a prerequisite of three or more courses.

(2) Electives chosen only from courses numbered 300 or above.

Special Programs for Exceptional Students

A few exceptional students in the Division of Science will be permitted to do special individual work in the Senior College if such a program is likely to meet their needs better than the regular program. Students who wish to enter individual programs must have an all-college average of at least 3.0 and an average higher than 3.0 in the major field of study. The student's advisors must be satisfied that the student has the physical and mental health, the initiative and

intellectual curiosity, the basic drive, and other personal qualities which are necessary for success. The candidacy must have the approval of the Dean of Science who, in consultation with the student and with others concerned, will appoint a committee to direct the work. The plan must be approved by the Dean of Science. Candidates should apply at the office of the Dean of Science.

The student and his committee will plan as many economies as possible in the program in order to allow time for the development of an individual project in the major field. The plan will not permit the elimination of any essential knowledge or discipline and should bring about better integration and balance in the student's work. It is hoped that exceptional students will be able to use individualized programs as a means of developing their powers as fully as possible.

Preparation for the Study of Medicine

Students preparing for the regular curriculum in veterinary medicine, for admission to which two years of college work is required, will take the preliminary year in the Division of Science as outlined on page 143 with modifications suggested by the student's counselor. See also restricted enrollment in the Division of Veterinary Medicine, page 149.

Students preparing for the study of human medicine will take at least the work of the first three or four years of the curriculum in science. The general outline, as described on pages 143 and 144, will be followed with modifications in terms of the requirements of the medical school which the student plans to enter. Modifications will be suggested by the student's counselor and submitted to the Dean of Science for approval.

Curriculum in Chemical Technology

Leading to the degree of Bachelor of Science.

Freshman Year

Each student will be required to include in his schedule, in addition to the courses listed below, Science 100 (Fall), Library 106D (Spring); Physical Education each quarter (for women, 1 credit for the year; required of men without credit); Military 111, 112, 113 (men) credit 1 each quarter, or Naval Science 111, 112, 113 (men) 3 credits each quarter.

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
General Chemistry Chem. 101	4	General Chemistry Chem. 102	4	Qualitative Analysis Chem. 103	4
Prin. of Composition Engl. 101	3	Prin. of Composition Engl. 102	3	Prin. of Composition Engl. 103	3
College Algebra Math. 101	5	Plane Trigonometry Math. 102A	5	Analytic Geometry Math. 103	5
General Biology Zool. 104	3	General Biology Zool. 105	3	General Botany Bot. 101C	3
	16 to 18		16 to 18		16 to 18

Students with advanced standing deficient in biology may elect Zool. 101 and Bact. 304A.

Sophomore Year

Each student will be required to include in his schedule each quarter, in addition to the courses listed below, Physical Education (for women, 1 credit for the year; required of men without credit); Military 221, 222, 223 or Air Science 241, 242, 243 (men) 1 credit for each quarter; or Naval Science 211, 212, 213 (men) 3 credits each quarter.

Inorganic Chemistry Chem. 201	2	Inorganic Chemistry Chem. 202	2	Quantitative Analysis Chem. 217	5
Quantitative Analysis Chem. 215	5	Quantitative Analysis Chem. 216	5	Drawing & Projection E.Dr. 131	2
Propaganda Analysis Engl. 205	3	Differential & Integral Calculus II Math. 212	4	Applied Calculus Math. 213	4
Differential & Integral Calculus I Math. 211	5	General Physics Phys. 221	5	General Physics Phys. 222	5
	16 to 18		17 to 19		17 to 19

Junior Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Physical Chemistry Chem. 321	4	Physical Chemistry Chem. 322	4	Physical Chemistry Chem. 323	4
Lab. in Organic Chemistry Chem. 330	2	Lab in Organic Chemistry Chem. 330	2	Lab. in Organic Chemistry Chem. 330	2
Organic Chemistry Chem. 331	3	Organic Chemistry Chem 332	3	Organic Chemistry Chem. 333	3
[1]German M.L. 441	3	[1]German M.L. 442	3	American Government Govt. 315A	3
General Physics Phys. 223	5	Speech-Making Speech 311	3	[1]German M.L. 443	3
	17		15		15

Senior Year

Elements of Chem. Engr. Chem.E. 441	3	Adv. Qual. Analysis Chem. 403	4	Elements of Chem. Engr. Chem.E. 443	3
Microscopic Chem. Anal. Chem. 518	3	Elements of Chem. Engr. Chem.E. 442	3	Quant. Microchem. Anal. Chem. 519	3
[2]Electives	10	[2]Electives	9	[2]Electives	10
	16		16		16

[1]Those desiring to elect a biology, geology, physics, or other sequence approved by the head of the department and the dean of the division may take M.L. 441, 442, 443, as an elective in the senior year.

[2]Of the twenty-nine elective credits nine credits will be required in the field of industrial economics and nine in advanced chemistry, physics or mathematics.

Curriculum in Agricultural Business and Rural Administration

Administered jointly by the Division of Agriculture and the Division of Science in the Department of Economics and Sociology. See page 92.

Division of Veterinary Medicine

HENRY D. BERGMAN, D.V.M., Dean of Veterinary Medicine

Veterinary Administration Building, Room 200

The Division of Veterinary Medicine of Iowa State College was established in 1879 and is now the oldest school of veterinary medicine in the United States.

It includes the Departments of Anatomy, Hygiene, Medicine, Obstetrics and Radiology, Pathology, Physiology and Pharmacology, and Surgery. Instruction in chemistry and other related sciences is provided by departments outside the division. Aside from the seven strictly educational departments and the hospital and ambulatory clinics, there are also the Veterinary Research Institute and the Iowa Veterinary Diagnostic Laboratory, which give the student opportunity to observe those phases of veterinary medicine for which these laboratories are especially responsible.

The location of the College in the center of the richest livestock country in the world provides a rare opportunity for the veterinary student to study animal industry; it also enables him to observe a wealth of clinical cases both at the hospital clinic and under general practice conditions through the ambulatory clinic.

A minimum of two years of prescribed preprofessional college work, with a creditable academic average, are required for admission to the professional curriculum in veterinary medicine. (See entrance requirements on page 149.) The professional curriculum extends over a period of four years and leads to the degree of Doctor of Veterinary Medicine.

Candidates for graduation must be twenty-one years of age, of good moral and professional character, must have at least 2 quality points per credit in all courses taken in the professional curriculum, and must be approved by all departments of the division, to secure the degree of Doctor of Veterinary Medicine.

AWARD OF THE WOMEN'S AUXILIARY OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION. This is an annual award of $25 to a senior veterinary student. The selection of the recipient is based upon some creative activity, other than scholarship, carried on by the student during his junior and senior years.

BORDEN SCHOLARSHIP AWARD IN VETERINARY MEDICINE. The Borden Company Foundation of New York has established an annual scholarship award of $300 to be presented to the student in veterinary medicine who has achieved the highest average grade of all students in the veterinary curriculum preceding his senior year. The amount of the award is presented to the recipient in the Fall Quarter of his senior year.

GEORGE JUDISCH SCHOLARSHIP PRIZE. This prize consists of the initiation fees and annual dues for four years of membership in the American Veterinary Medical Association, including subscription to the official journal, and is awarded each year to the senior student with the highest scholastic record in the Division of Veterinary Medicine.

G. G. GRAHAM PRIZES. These are cash prizes awarded annually to the two outstanding senior students in clinical medicine on the basis of scholarship, attitude, and general adaptability.

PAUL F. STARCH PHI ZETA AWARD. This award is made annually to a freshman veterinary student who, at the end of the freshman year, has shown those quali-

ties of character, interest, and leadership which the Society of Phi Zeta emphasizes.

VETERINARY MEDICAL SOCIETY. All veterinary students are members of the Iowa State Junior Chapter of the American Veterinary Medical Association. The bi-weekly meetings of the society, devoted to discussions of professional topics, promote the literary and social development of the members.

PHI ZETA. Members are chosen from those who rank scholastically in the upper tenth of the junior class and the highest fourth of the senior class. Character and qualities of leadership are also considered.

OTHER HONOR SOCIETIES. Students of veterinary medicine are also eligible for membership in the national honor societies of Phi Kappa Phi and Gamma Sigma Delta, and graduate students to membership in Sigma Xi.

Entrance Requirements

Admission to the Division of Veterinary Medicine is granted only at the beginning of the Fall Quarter. Applicants for admission must file a certificate showing that their high school record meets the entrance requirements as set forth on page 76. College credits of the preprofessional work must average at least 2.25 on a four-letter marking system with "A" as the highest mark and "D" as the lowest passing mark (for explanation of the marking system, see page 84), if the application is to receive consideration by the Committee on Selective Admission. The above scholastic requirements are minimum. For other factors in selective admission, see Restricted Enrollment below.

Applicants for admission must present 1½ units of algebra and 1 unit of plane geometry and a total of not less than two years (90 quarter or 60 semester credits) of work in an approved college or university. The college credits must include:

English	9 qr crs	(6 sem. crs)
Chemistry { General 12, Organic 8 }	20 qr. crs.	(14 sem crs.)
Mathematics and/or Physics	8 qr. crs.	(6 sem. crs)
Biological Science { Zoology 8, Botany 3, Genetics 3 }	14 qr. crs.	(10 sem crs.)
American Government or American History	3 qr. crs.	(3 sem. crs.)
Animal Husbandry	9 qr. crs.	(6 sem. crs.)
Poultry Husbandry	3 qr. crs.	(2 sem. crs.)
Total required credits	66 qr. crs.	(47 sem. crs.)
Electives	24 qr. crs.	(13 sem. crs.)
Grand Total	90 qr. crs.	(60 sem. crs.)

In view of the animal husbandry and poultry husbandry requirements it is advisable for the student to take his preveterinary work at an institution where those courses are given. A course in feeds and feeding is highly recommended as a part of the animal husbandry requirements.

Students who desire to take preprofessional work at the Iowa State College will enroll in the Division of Science.

Restricted Enrollment

Recently, the College has been receiving applications for admission to the curriculum in veterinary medicine from more students than can be effectively trained with the present educational facilities. For this reason, it has become necessary to limit the enrollment in the first-year class in veterinary medicine to approximately sixty-four students.

In selecting the candidates for the first-year class, a personal conference may be required with members of the veterinary faculty, or other persons designated by the Dean. High school records, scholastic performance in preprofessional studies, evidence of good character, and satisfactory personality will be given special consideration in the acceptance of applicants. Other qualifications being equal, residents of Iowa will be given preference.

Those who are applying for admission in September must file high school records and formal applications for admission by March 1. A transcript of all college courses completed up to that time should be sent to the Registrar. The transcript must also include a list of any additional courses that the applicant expects to complete by June 15.

Readmission

A veterinary student who voluntarily withdraws from college, or who is dropped for cause, forfeits his standing and must apply for readmission at any future time.

Curriculum in Veterinary Medicine

Leading to the degree of Doctor of Veterinary Medicine.

First Year

Fall Quarter	Credits	Winter Quarter	Credits	Spring Quarter	Credits
Physiological Chemistry Chem. 374	5	Physiological Chemistry Chem. 375	5	Microscopic Anatomy Vet. Anat. 103	5
Microscopic Anatomy Vet. Anat. 101	5	Microscopic Anatomy Vet. Anat. 102	4	Gross Anatomy Vet. Anat. 113	4
Gross Anatomy Vet. Anat. 111	5	Gross Anatomy Vet. Anat. 112	6	Mammalian Physiology Vet. Phys. 164	6
	15		15		15

Second Year

Poisonous Plants Bot. 456	3	Pathogenic Bacteriology Vet. Hyg. 225	5	Virology Vet. Hyg. 226	4
Genl. Bacteriology Vet. Hyg. 224	6	Genl. Pathology Vet. Path. 255	4	Special Pathology Vet. Path. 256	7
Genl. Pathology Vet. Path. 254	3	Parasitology Vet. Path. 257	4	Parasitology Vet. Path. 258	4
Mammalian Physiology Vet. Phys. 265	6	Mammalian Physiology Vet. Phys. 266	6	Genl. Pharmacology Vet. Phys. 267	3
	18		19		18

Third Year

Medicine Vet. Med. 331	5	Medicine Vet. Med. 332	5	Medicine Vet. Med. 333	5
Obstetrics Vet. Obst. 345	5	Small Animal Med. Vet. Med. 336	5	Small Animal Med. Vet. Med. 337	*6
Pharm. & Thera. Vet. Phys. 367	3	Pharm. & Thera. Vet. Phys. 368	3	Pharm. & Thera. Vet. Phys. 369	3
Surgery Vet. Surg. 371	5	Surgery Vet. Surg. 372	5	Surgery Vet. Surg. 373	5
Clinics Med., Obst., Surg. Clin. 381	**R	Clinics Med., Obst., Surg. Clin. 382	**R	Clinics Med., Obst., Surg Clin. 383	**R
	18		18		19

Fourth Year

Applied Anatomy Vet. Anat. 402	3	Dairy Hygiene Vet. Hyg. 420	4	Prof. Orientation Vet. Med. 438	2
Infectious Diseases Vet. Hyg. 421	4	Infectious Diseases Vet. Hyg. 422	4	Infectious Diseases Vet. Hyg. 423	4
Disturbances of Reproduc. Vet. Obst. 444	4	Animal Nutrition Vet. Phys. 465	3	Meat Hygiene Vet. Hyg. 426	3
Applied Avian Pathology Vet. Path. 450	3	Clinics Med., Obst , Surg. Clin 482	3	Clinical Conferences Vet. Med. 484	2
Clinics Med., Obst., Surg. Clin. 481	3	Radiology Vet. Obst. 440	3	*Post Mortem & Clin. Path., Vet. Path 455	3
				Clinics Med., Obst., Surg. Clin. 483	3
	17		17		17

*Credit given this quarter for work extending throughout the year.
**R indicates course is "required" without credit.

Graduate College

DEAN RALPH MALCOLM HIXON, Ph.D., Beardshear Hall, Room 110

(See Announcement of the Graduate College for complete details.)

The Iowa State College is a technical institution. Its Graduate College offers to qualified students opportunity to pursue advanced courses and to undertake research in agriculture, engineering, home economics, science and veterinary medicine. No major graduate work is offered in liberal arts subjects. Most of the departments give courses and direct research leading to the degree of Master of Science; a smaller number offer major work leading to the degree of Doctor of Philosophy. Many departments have special requirements for advanced degrees supplementing the general rules.

The immediate aims of graduate study differ from those of undergraduate study. The graduate student should seek to develop the power of independent work, to become imbued with the true spirit of research, to specialize without becoming narrow. He is expected to read widely in those fields related to his major work, and to become familiar with the workers actively engaged in productive research. The master's and doctor's examinations, particularly the latter, should show a wide acquaintance with the literature of the major and minor fields of specialization.

Admission

I. APPLICATION AND TRANSCRIPT OF RECORD. The prospective graduate student may secure application blanks for admission to the Graduate College from either the Registrar or the Dean of the Graduate College. He should forward these blanks, together with official transcripts and statement of quartile rank, to the Registrar or the Dean of the Graduate College, a month before the opening of the quarter when he wishes to matriculate. If the student has taken the Graduate Record Examination, the individual report chart should also be submitted. If the application is approved, an admission slip is sent by the Registrar to the Dean of the Graduate College and a copy is sent to the student.

II. QUALIFICATIONS. To be admitted to the Graduate College the prospective student must be a graduate of an institution whose requirements for the bachelor's degree are substantially equivalent to those of the Iowa State College. Scholastically, the applicant must have been in the upper half of the class in which he was graduated.

A. Unrestricted Admission.

Graduates of institutions on the approved list of the Association of American Universities will be admitted to the Graduate College provided the departmental requirements for the proposed major fields have been met.

B. Provisional Admission.

1. Graduates of institutions not on the approved list of the Association of American Universities but on lists of recognized regional accrediting associations will be admitted provisionally to the Graduate College if the departmental requirements for the major fields have been met. The qualifications and accomplishments

of students thus provisionally admitted will be reviewed by the major department at the end of one quarter in residence, and the status of the student will be determined by the Graduate Committee. In general, graduates of recognized foreign universities will be admitted in accordance with the provisions of this paragraph.

2. Graduates of institutions accredited by recognized regional associations as "Institutions Primarily for the Training of Teachers" who plan to take major work in the fields of education offered at the Iowa State College may be admitted provisionally. They will not ordinarily be admitted to graduate standing with major in other fields.

3. Graduates of institutions not on the approved lists of the Association of American Universities or the recognized regional accrediting associations are in general not eligible for admission to the Graduate College. Exception may be made by the Graduate Committee provided the prospective candidate passes special examinations covering preparation in the proposed major and related fields, and such other tests as may be set. Students admitted under this provision may qualify for unconditional admission only after completion of one quarter's successful work and upon review of all circumstances and approval by the major department and the Graduate Committee.

C. Limited Admission.

Applicants who wish to enroll for graduate work and are not candidates for advanced degrees at the Iowa State College may be admitted to the Graduate College for one quarter, a maximum of 15 credits, without submitting transcripts. Such students are expected to meet all departmental requirements and course prerequisites, however. Such applicants will be required to submit a certificate of graduation from the college from which they received their Bachelor's or higher degree.

Registration and Classification

I. Preliminary Classification. After consulting the head of his major department and the professor in charge of his major work, the student makes out quadruplicate classification schedules, called "Time Cards," and secures on them the signature of these two officials. If no major department is chosen, the Dean of the Graduate College is in charge. Time cards are available in the departmental offices.

II. Classification With the Dean. The student presents the time cards, properly filled out and signed, at the office of the Dean of the Graduate College for checking. After they have been approved and signed by the dean, the student leaves two in that office and takes two to the office of the Registrar, where he secures class cards and fee cards.

III. Payment of Fees. Fees are assessed by the office of the Registrar, and paid at the office of the Treasurer. Students on graduate appointments obtain staff cards at the Graduate College Office before classification.

IV. Medical Examination. Each new student is required to report for health examination at a time set by the Student Health Service.

Interim Classification

Graduate students who are in residence during periods between the closing and opening of the regular quarters of the academic year may upon special permission register for graduate work under the regular members of the instructional staff who are in residence. Students may register in not to exceed one credit per week. Fee for such classification is $5.00 per credit.

Classification in Absentia

Graduate credit is not allowed for correspondence courses. In exceptional cases permission is granted to students who have been in residence in the Graduate College to do a limited amount of work *in absentia*. The total credit thus obtained cannot exceed that previously gained in residence. *In absentia* classification may not be considered a part of the year and a half minimum residence for the doctor's degree or the thirty weeks minimum for the master's degree. *In absentia* registration is usually limited to research carried on in an institution where facilities are adequate or to preparation of a thesis after all other requirements have been met. Permission to classify *in absentia* must be given by the head of the student's major department and approved by the Dean of the Graduate College. Fee for such classification is $1 per credit.

Classification in Extension and Off-Campus Classes

Classes away from the campus in guidance and industrial education are taught by members of the Engineering Extension and Vocational Education staffs who are officers of instruction in the Graduate faculty. Credits earned in such classes cannot be considered a part of the year and a half minimum residence for the doctor's degree nor of the thirty week minimum for the master's degree.

Fees and Expenses

For fees required of graduate students, see page 79.

Graduate Appointments

Fellowships, Graduate Assistantships, Industrial Fellowships and certain special research grants have been established at the Iowa State College for the encouragement of graduate work and the promotion of research. These appointments are open to students who have graduated from approved colleges in the highest quartile of their respective classes and who present the requisite undergraduate or graduate preparation.

Such appointments and research opportunities are available through the various departments of instruction, administrative committees and the Agricultural Experiment Station, the Engineering Experiment Station, the Industrial Science Research Institute, the Statistical Laboratory and the Institute for Atomic Research. Application blanks and further information may be secured by writing to the Dean of the Graduate College, Room 110, Beardshear Hall. These blanks should be returned to the dean's office not later than March 1. In most cases recommendations for appointment are made about April 1. Appointments are made throughout the year as vacancies occur.

Fellowships carry stipends of $540-$720 per academic year and permit the holder to enroll for a full graduate program of fifteen credits per quarter. A

Fellow is expected to give one-fourth time service to the teaching or research projects of his department.

Graduate Assistantships pay from $810 to $1,125 per academic year and permit the holder to enroll for two-thirds of a full schedule or eleven credits per quarter. A Graduate Assistant is expected to give half-time service to the teaching or research projects of his department.

Special Research and Industrial Fellowships are offered each year either by the College or other agencies for the study of special problems. The stipend varies with the nature and importance of the work and the preparation of the candidate.

For registration fees, see page 79. The satisfactory completion of one appointment will ordinarily make a student eligible for reappointment.

Post Doctoral Study

Post doctoral students not holding appointments on the staff may be designated as collaborators and given staff privileges upon recommendation of the head of the department concerned through the office of the Dean of the Graduate College to the President. Those who are admitted from foreign countries on a student visa must register and classify as graduate students, as must also all who wish to have graduate credits recorded.

Graduate Study by Members of the Staff

I. Members of the Staff on Full-Time Employment. Any member of the research, instructional or extension staffs of the rank of instructor, associate, or junior scientist subject to the approval of the head of his department or section, may carry not to exceed five credits of graduate work per quarter, provided such does not interfere with his other duties. This privilege may be extended to members of the research, instructional or extension staffs of the rank of assistant professor upon approval of the dean concerned and of the President.

II. Members of the Staff on Part-Time Employment. All adjustments as to amount of work to be taken for credit by members of the staff on part-time employment shall be fixed at time of appointment. In general, one additional credit of graduate work may be carried for each diminution by one-twelfth from full-time employment.

III. Summer School. Other members of the staff may enroll in graduate work during the Summer Quarter if not on duty and not receiving salary from the College during this time. If holding the rank of professor or associate professor they cannot become candidates for degrees from this institution.

Requirements for the Degree of Master of Science

The following requirements must be met by all candidates for the degree of Master of Science.

Further requirements may be prescribed by the major departments.

I. Residence. Three quarters, or a minimum of thirty weeks of full-time graduate study, must be spent in residence at the Iowa State College.

Arrangements have been made whereby graduate students in certain departments may earn a portion of their residence credit at the State University of Iowa.

II. CREDITS. At least forty-five credits of acceptable graduate work must be completed, not less than thirty-six of which must be taken in this institution.

Any transfer of credits from another institution to apply in partial fulfillment of the requirements for the master's degree must be recommended by the head of the major department and approved by the Graduate Committee.

III. MAJOR AND MINOR. The exact number of credits in major and minor fields is not prescribed. To obtain the specialization which is considered essential for a professional degree, approximately two-thirds of the work should be devoted to the major field, but this is not necessarily restricted to one department. Designation of a minor field is advisable to avoid the narrow training so often criticized in graduate study. If the minor is taken in the major department, it must be in a distinct subdivision of that department.

A graduate student may not change from one major to another without written permission from the heads of both departments and the Dean of the Graduate College.

Credit in major work can be secured only by completion of courses chosen from the lists given in the graduate catalogue headed "Open to Graduates Only, Major or Minor", and "Open to Graduates and Advanced Undergraduates, Major or Minor". Courses for minor credit may be chosen from either of the lists mentioned above, and if chosen in a department other than the Major, from the list headed "Open to Graduates for Minor Only".

Other courses may be taken as supporting work but will not be credited toward an advanced degree.

IV. MODERN LANGUAGES. Except when specifically waived in the description of requirements of the student's major department in this catalogue, a satisfactory reading knowledge of French, German or Russian must be certified by the Examiner in Modern Languages prior to admission to candidacy. In special cases, upon recommendation of the head of the department in which the major work is taken and approval of the dean, some other foreign language of particular value to the work of the candidate may be substituted.

Students who are unable at the time of their admission to meet the foreign language requirement in the department in which the major work is taken should not expect to complete the work for the degree of Master of Science in the minimum length of time.

V. ADVANCEMENT TO CANDIDACY. A student registered in the Graduate College may become a candidate for the degree of Master of Science by conforming to the following regulations:

A. PRELIMINARY RESIDENCE REQUIREMENT. The student must have been registered in the Graduate College for at least one quarter.

A student admitted on the "A" basis (Unrestricted Admission) and who graduated in the upper twenty-five per cent of his graduating class is eligible to continue study for the master's degree.

A student admitted on the "A" basis but ranking below the upper twenty-five per cent of his graduating class, and a student admitted on the "B" basis (Provisional Admission) may be admitted to candidacy only after completing one quarter's work with a "B" average.

B. Application for Admission to Candidacy. Form VI, requesting admission to candidacy, may be secured from the office of the dean. This application must be approved and signed by the head of the department in which the major subject is offered and by the person in charge of the major, and must include certification that all modern language and English requirements have been met.

This form must be filed in the office of the Dean of the Graduate College by midterm of the quarter before the student expects to take the degree.

C. Approval. When the Graduate Committee has approved the application for admission to candidacy, Form VII is sent to the department head (copy to student) giving the exact thesis title as approved and providing space for requesting committee appointment and examination date. This form should be filled out, signed by the department head, and returned to the office of the Dean of the Graduate College at least four weeks before the date of examination.

VI. Diploma Slip. A diploma slip (obtained at the office of the Dean of the Graduate College) must be filled out and returned with Form VI (see above) to the Graduate Office by midterm of the quarter before the student expects to take the degree.

VII. Examination. Final examination shall be taken on all graduate work including the thesis. This examination shall be in charge of a special committee of members of the Graduate Faculty appointed by the Dean of the Graduate College after recommendation has been submitted by the head of the student's major department. It will ordinarily be oral, but may be written in whole or in part, as determined by the committee in charge. The purpose of this examination is to determine the candidate's general fitness and preparation. This examination shall be held at such time and place as are recommended by the department head and approved by the dean, and shall be completed at least two weeks prior to the close of the quarter in which the degree is to be granted.

VIII. Thesis. Presentation of a thesis is required by all departments. Joint theses are not acceptable. Copies of the completed thesis must be in the hands of the examining committee and the Librarian for approval one week prior to the date fixed for the final examination. After the final examination two complete and approved typewritten copies of the thesis shall be deposited with the Librarian for binding. These copies of the thesis must be deposited not less than one week prior to commencement. A charge of $5 will be made to cover library costs and title publication in the Iowa State College Journal of Science.

The student should consult the *Manual on Thesis Writing,* prepared for the use of students in the Graduate College, before arranging for the typing of his thesis.

Requirements for the Degree of Doctor of Philosophy

The primary requirements for the degree of Doctor of Philosophy are three: (1) High attainment and proficiency of the candidate in his chosen field, (2) Development of a thesis which shall be a real contribution to knowledge and which shall show power of independent and creative thought and work, and (3) Successful passing of detailed examinations over the field of the candidate's major work, with a satisfactory showing of his preparation in related and minor courses.

Upon admission of the graduate student to work looking toward the degree of Doctor of Philosophy, the department head shall recommend to the Dean of the Graduate College a committee of the Graduate Faculty to be in charge of his work. This committee shall consist of the following: The faculty member

who will be in charge of the major research (chairman), representatives of the departments in which major and minor work are to be taken, and such other representatives of the Graduate Faculty as may be appointed by the dean. This committee shall file with the Dean of the Graduate College, at least two quarters in advance of the preliminary examination, an outline (Form X) of the graduate program to be pursued by the student.

The degree of Doctor of Philosophy may be conferred upon candidates who have met the following requirements:

1. RESIDENCE. A minimum of three years shall be spent in full-time graduate study, at least one-half of which is to be in residence at the Iowa State College. At least three quarters of resident study must be during the academic year. To satisfy any one-year residence requirement at least thirty-six credits must be earned. Any transfer of graduate credit from another institution must be recommended by the student's committee and approved by the Graduate Committee. A transfer involving a master's degree granted elsewhere requires the approval of the master's thesis as a thesis of distinction by the student's committee. Transfer of other graduate credit should be approved only if it is of "B" grade or better.

The degree will be conferred not solely as a result of faithful study over any period, but for research work of a scholarly character, and successful passing of all examinations.

II. MAJOR AND MINOR WORK. Major work shall be taken in one department or subdivision of a department, or in exceptional cases in two closely related departments. A first and a second minor shall be chosen, one of which shall be taken in a separate department from that in which the major is taken.

III. MODERN LANGUAGES. A satisfactory reading knowledge of French and German must be certified by the Examiner in Modern Languages before application is made for preliminary examination. In special cases, upon recommendation of the student's committee and approval of the Graduate Committee, another language, such as Russian, of direct value in the candidate's research field may be substituted for either French or German.

IV. PRELIMINARY EXAMINATION AND ADVANCEMENT TO CANDIDACY. The student admitted with less than a "B" average will be required to maintain a "B" average for two quarters in residence at the Iowa State College before becoming eligible to candidacy for the degree. The student must pass satisfactorily a preliminary examination before admission to candidacy for the degree. It must be passed at least three quarters before the final examination. Exceptions to this rule will be made only upon special recommendation of the student's committee and approval of the Graduate Committee. In no case may the final examination be given in less than six months from the time of the preliminary examination. The dates and places for this examination will be fixed by the dean upon recommendation of the committee in charge.

The preliminary examination for the doctorate will not be scheduled in the second term of the summer quarter. Exceptions to this rule will be made only in case the chairman, the professor in charge of each of the minors, and at least one other member of the candidate's regular committee, signify in writing that they will be in residence and will be present for the examination. Substitutes for other members may be designated.

V. THESIS. A doctoral dissertation (thesis) shall be completed on some topic connected with the major subject. To be acceptable it must constitute a real contribution to knowledge. Joint authorship is not permitted.

Copies of the completed thesis must be in the hands of the examining committee and the Librarian for approval one week prior to the date fixed for the final examination. After the examination, and at least one week prior to commencement, two complete and approved typewritten copies of the thesis shall be depposited with the Librarian for binding.

At the time the thesis is deposited, two typewritten copies of an acceptable and approved abstract, must also be filed with the Librarian for publication in the Iowa State College Journal of Science. For an abstract of three pages, or fraction thereof, a charge of $25 will be made to cover cost of printing in the Journal. An additional charge of $10 will be made for each additional page, or fraction thereof. The abstract should cover the entire thesis and should not be considered as excluding publication of a journal article which normally would be confined to a portion of the research.

The student should consult the *Manual on Thesis Writing,* prepared for the use of students in the Graduate College, before arranging for the typing of his thesis.

VI. EXAMINATION. Final examinations shall be taken on all graduate work including thesis. This examination shall be conducted by the student's committee with such other members of the faculty as may be designated by the Dean of the Graduate College. It will be written or oral, or both, as determined by the committee.

The final examination for the doctorate will not be scheduled in the second term of the Summer Quarter. Exception to this rule will be made only in case the chairman, the professor in charge of each of the minors, and at least one other member of the candidate's regular committee signify in writing that they will be in residence and will be present for the examination. Substitutes for other members may be designated.

VII. DIPLOMA SLIP. A diploma slip (obtained at the office of the Dean of the Graduate College) must be filled out and returned by midterm of the quarter before the student expects to take the degree.

Departments of Graduate Instruction

For complete information concerning the graduate offerings of each department and the sub-fields in which graduate students may major or minor in each department, see the announcement of "Opportunities for Graduate Study" in the departmental course descriptions in this catalog (see page 159) or write for the Announcement of the Graduate College.

Collegiate Instruction

DEFINITION OF A CREDIT. The value of each course is stated in quarter credits. A one-credit course requires one recitation involving two hours of preparation, or one three-hour laboratory period, or other combination of teacher-student contact and outside preparation involving a total of three clock hours per week for twelve weeks

COURSE NUMBERS. In each department the courses, for convenience of reference, are given in numerical order. The courses are divided into groups as follows:

1- 99—Courses for noncollegiate students.

100-299—Courses primarily for junior college students.

300-499—Courses primarily for senior college students.

500-599—Courses for advanced undergraduate students and for graduate students for major or minor credit.

600-699—Courses for graduate students for major or minor credit.

After the description title of each course are three numbers in parentheses. The first indicates the number of lectures a week, the second the number of recitations, and the third the number of hours of laboratory a week. For example, a course title followed by (1-2-3) is a course with *one* lecture, *two* recitations, and *three* hours of laboratory a week.

At the end of the first line of each course description will be found one of the following letters: F. W. S. SS., indicating which of the four quarters—fall, winter, spring, summer session—of the college year the course is offered. Alt. is the abbreviation for alternate. The abbreviation Yr. is used to designate a sequence of three courses taught fall, winter, and spring, respectively. If there is sufficient demand, courses may be offered more frequently than announced.

Aeronautical Engineering

CARL NICHOLS SANFORD, M.S., Head of Department

Professor: Ernest Willard Anderson, Ph.D.

Assistant Professor: Robert Franklin Rautenstrauch, M.S.

Instructor: Walker

Opportunities for Graduate Study

For undergraduate curriculum in aeronautical engineering leading to the degree of Bachelor of Science, see page 115.

Courses offered by this department train the student for aircraft design or aeronautical research work.

Pilot training ground and flight instruction are given on the campus and at the municipal airport through the local flight operators.

Opportunities for Undergraduate Study

The department offers major work for the degree of Master of Science in aeronautical engineering, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of a curriculum substantially equivalent to that required of undergraduate students in aeronautical engineering at this institution.

Open to graduate students for minor only: 360, 380, 410, 411, 415, 420, 430, 432, 440 and 470.

Description of Courses

Courses Primarily for Undergraduate Students

100. **Technical Lecture.** (1-0-0) Required. **S.**
Orientation in the field of Aeronautical Engineering.

212. **Pilot Training Ground Instruction.** (0-2-3) Cr. 3. **F.W.S.**
Instruction in meteorology, navigation, and Civil Air Regulations to meet the requirements for the Civil Aeronautics Administration certificate of competency.

214. **Advanced Pilot Training Ground Instruction.** (0-3-3) Cr. 4. **F.W.S.**
Prerequisite: 212.
Aircraft (aerodynamics and structures) instruments, parachutes, navigation, power plants (engines, propellers, and accessories) from the operational viewpoint of the airplane pilot.

216. **Pilot Training Flight Instruction I.** (0-0-3) Cr. 1 **F.W.S.**
Prerequisite: Credit or classification in 212.
Ten hours dual flight instruction (or the equivalent in combined dual and solo time) in conventional or unconventional aircraft in preparation for solo flight. Fee $94, of which a pro rata refund will be made if the student is required by the College to discontinue training.

218, 219, 220. **Pilot Training Flight Instruction II.** (0-0-3) Cr. 1 each. **F.W.S. each.**
Prerequisite: 216, credit or classification in 214.
Ten hours dual flight instruction per course (or equivalent in combined dual and solo time) in conventional or unconventional aircraft in preparation for the Civil Aeronautics Administration Private Pilot Certificate. Fee $94 for each course, of which a pro rata refund will be made if the student is required by the College to discontinue training.

221. **General Aeronautics.** (0-3-0) Cr. 3. **F.**
Prerequisite: Math. 103.
Aeronautical history, nomenclature, theory of flight, meteorology, instruments, radio aids, recent developments.

222. **Aircraft Materials.** (0-2-0) Cr. 2. **W.**
Prerequisite: 221.
Materials currently employed in aircraft construction

223. **Aircraft Construction.** (0-2-0) Cr. 2. **S.**
Prerequisite: 222.
Fabrication techniques and design procedures used in aircraft manufacture.

301. **Aeronautical Problems.** (0-3-0) Cr. 3. **F.**
Prerequisite: Math. 314.
Organization of computations and rapid, approximate methods of problem solution.

310. **Aerodynamics I.** (0-3-3) Cr. 4. **W.**
Prerequisite: T.&A.M. 378.
Properties of air and the atmosphere, stream functions, theory of lift of infinite and finite wings, nature of drag, propeller characteristics.

360. **Aerodynamics II.** (0-3-3) Cr. 4. **S.**
Prerequisite: 310.
Performance of low speed, reciprocating engine powered airplanes.

370. **Aircraft Materials and Processes.** (0-2-6) Cr. 4. **W.**
Prerequisite: T.&A.M. 324.
Materials, fabricating techniques, and design procedures used in aircraft manufacture.

380. **Stress Analysis I.** (0-3-6) Cr. 5. **S.**
Prerequisite: T.&A.M. 324
Distribution of air loads to the airplane structure and semi-monocoque stressed skin analysis.

400. **Inspection Trip.** Required. **F.**
Prerequisite: Senior Aero. Engr. classification.
Inspection trip to aeronautical concerns and activities.

410. **Stability and Control.** (0-3-0) Cr. 3. **F.**
Prerequisite: 360.
Stability and control of airplanes for zero angular acceleration.

411. **Reaction Propulsion.** (0-3-0) Cr. 3. F.W.
Prerequisite: M.E. 322, 344.
Turbo-jet, turbo-prop, pulse jet, ram jet, and rocket propulsion systems for aircraft.

115. **Advanced Stability and Control.** (0-3 to 5-0) Cr. 3 to 5. F.W.S.
Prerequisite: 410.
Stability and control involving angular accelerations.

420. **Stress Analysis II.** (0-4-0) Cr. 4. F.
Prerequisite: 380.
Indeterminate components of airplane structures.

422. **Stability of Aircraft Structures.** (0-3-0) Cr. 3. W.
Prerequisite: 420.
Buckling theory, permanent deformations and allowable loads on thin metal structures.

425. **Airplane Static Testing.** (0-1-3 to 9) Cr. 2 to 4. F.W.S.
Prerequisite: 420 and permission of instructor.
Evaluation of static test loads. Laboratory determination of stress patterns; correlation of theory and test data.

430. **Airplane Design I.** (0-2-6) Cr. 4. W.
Prerequisite: 380 and credit or classification in 410.
Preliminary design of an airplane. Design procedure, specifications, weight and balance. Practical application of aerodynamic and structural principles.

432. **Airplane Design II.** (0-2-6) Cr. 4. S.
Prerequisite: 430.
Design of components of airplane studied in 430. Drafting practice, comparative manufacturing costs, weight.

440. **Flight Testing.** (0-2-6) Cr. 4. S.
Prerequisite: Credit or classification in 360.
Flight test methods. Flight testing college airplane. Instrument theory. Instrument testing. Aircraft components.

470. **Aeronautical Problems.** (As arranged) Cr. 3 to 6. F.W.S.
Prerequisite: 410.
Advanced work on aerodynamics and structural problems. Flight test problems.

491, 492, 493. **Aeronautical Seminar.** (1-0-0) Required. Yr.

Courses for Advanced Undergraduate and Graduate Students

541, 542, 543. **Advanced Aerodynamics.** (0-3-0) Cr. 3 each. Yr.
Prerequisite: 410. Mr. Anderson
Classical flow theory, compressible fluid theories, and shock wave studies.

595. **Special Topics.** Cr. 1 to 5. F.W.S.
Mr. Sanford

Courses for Graduate Students

620. **Seminar.** (1-0-0) Cr. 1.
Mr. Sanford

670. **Research.**
Mr. Sanford

Agricultural Economics

For description of courses, see Department of Economics and Sociology, courses in Economics, page 213.

Agricultural Education

For description of courses, see Department of Vocational Education, page 323.

Agricultural Engineering

Administered jointly by the Division of Agriculture and the Division of Engineering.

HOBART BERESFORD, A.E., Head of Department

Professors: Quincy Claude Ayres, C.E.; Edgar Vermont Collins, B.S.; J. Brownlee Davidson, D.Engr.; Richard K. Frevert, Ph.D.; Henry Giese, Arch.E.; William V. Hukill, B.S.; Vilas Jay Morford, M.Sc.; Claude Hall Van Vlack, M.S.

Associate Professors: Norval H. Curry, M.S.

Assistant Professors: Ray E. Armstrong, M.S.; Sherwood Searle DeForest, M.S.; Teddy O. Hodges, M.S.; Dale Otis Hull, M.S.; Carlton Egbert Johnson, M.S.; J. G. Porterfield, M.S.; Norval J. Wardle, Ph.D.

Instructors: Anderson, Bittinger, Hunt, Jedele, Johnson, Schwab, Woolsoncroft, Worlan, Yoerger

Opportunities for Undergraduate Study

For undergraduate curriculum in agricultural engineering leading to the degree of Bachelor of Science, see page 116.

Graduates from this curriculum have taken up work along the following lines: college, extension, experiment station, and government work in agricultural engineering; advertising, sales, and development work with manufacturers of various lines of farm equipment and farm building materials; engineering and contracting on farm buildings; soil erosion control, and drainage; rural electrification; editorial work on farm and trade journals; and farming where drainage, farm structures, and the use of machinery are important factors.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in soil and water conservation, agricultural machines, agricultural power, rural electrification, and agricultural structures; and minor work to students taking major work in other departments. Work may be taken for the degree of Doctor of Philosophy as a divided major with departments offering work in related fields for this degree.

Prerequisite to major graduate work is the completion of an undergraduate curriculum in agricultural engineering substantially equivalent to that required of undergraduate students at this institution.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: 345, 346, 425, 427, 436, 447, 462, 476, 487, 489, 496.

Description of Courses

Course for Noncollegiate Students

70. Management of Farm Equipment. (0-2-3) Cr. 3 W.
Design, selection and utilization of farm buildings; selection, operation and utilization of power and machinery units used in crop production and feed processing.

Courses Primarily for Undergraduate Students

100. Technical Lecture. (1-0-0) Required. S.
The field of agricultural engineering, its relation to the agricultural industry and to the engineering profession.

157. Dairy Mechanics. (0-0-6) Cr. 2. F.
For dairy industry students. Sanitary and common pipe fitting, soldering and sheet metal, oxy-acetylene and arc welding, silver soldering, electricity, and service and repair of dairy equipment.

224. **Fundamentals of Soil and Water Conservation Engineering.** (0-3-6) Cr. 5. S.
Prerequisite: C.E. 325, credit or classification in Math. 212.
Erosion control principles and practices. Design of drainage systems. Runoff measurements and analysis of hydrographic data as applied to design, location and construction of erosion control and drainage facilities. Field trips to problem areas.

236. **Agricultural Machines.** (0-2-3) Cr. 3. F.
Prerequisite: Credit or classification in Phys. 221.
Development, economic requirements, construction, efficiency, capacity, cost of use, testing, and selection of agricultural machines.

254. **Farm Mechanics.** (0-0-6) Cr. 2. F.W.S.
Use of hand and machine tools, forge and cold metal work, soldering and sheet metal, farm electricity, arc and oxy-acetylene welding, repair of farm machinery.

255. **Farm Carpentry.** (0-0-6) Cr. 2. F.W.S.
Selection, use and care of hand and power carpentry tools. Selection of building materials, construction of farm buildings and farm equipment.

256. **Advanced Carpentry.** (0-0-6) Cr. 2. S.
Prerequisite: 255.
Selection of building materials, estimating bills of materials, care and use of hand and power equipment, construction of buildings and farm equipment.

269. **Dairy Machinery.** (0-2-3) Cr. 3. F.
Construction and operation of steam boilers and engines, refrigerating machines, power transmission; pipe fitting and soldering.

279. **Farm Buildings and Equipment.** (0-3-6) Cr. 5. W.
Functional requirements of farm buildings. Selection and utilization of materials. Design of farm buildings. Estimating and specification writing.

289. **Farm Buildings and Equipment.** (0-2-3) Cr. 3. W.
Farmstead arrangement. Planning farm buildings with special regard to livestock requirements, economy, convenience, sanitation, appearance, and materials used. Farm utilities.

290. **Farm Buildings and Equipment.** (0-2-3) Cr. 3. S.
Prerequisite: 279 or 289.
Insulation and ventilation. Structural problems in farm buildings. Valuation, appraisal and estimating.

301, 302, 303. **Seminar.** (0-1-0) Required. Yr.
Preparation, presentation, and discussion of papers on agricultural engineering subjects.

306. **Soil and Water Conservation.** (0-2-3) Cr. 3. F.S
Engineering aspects of soil and water conservation for students in agriculture. Use of the level. Land description. Design, location and construction of erosion control and drainage facilities. Field trips to problem areas.

334. **Farm Machinery and Power Management.** (0-3-3) Cr. 4. F.W.S.
Prerequisite: Math. 205.
Mechanics and materials of farm machinery construction. Adjustment, selection, capacity and cost of use of farm machinery. Transmission, measurement, and cost of use of farm power.

345. **Gas Engines and Tractors.** (0-2-3) Cr. 3. W.
Prerequisite: 334.
Construction, operation, adjustment, capacity, and care of gasoline and oil engines and tractors.

346. **Agricultural Tractor Power.** (0-3-3) Cr. 4. S.
Prerequisite: Phys. 223, T.&A.M. 344.
Kinematics and dynamics of tractor power application; draw bar, power take-off, and traction mechanisms. Thermodynamic principles and construction of the internal combustion engine, fuels and carburetion, ignition. Rating and testing of tractors.

354. **Advanced Farm Mechanics.** (0-1-6) Cr. 3. F.S.
Prerequisite: 254.
Arc and oxy-acetylene welding and cutting, farm machinery repair, farm electricity, and farm plumbing.

355. **Wood Construction.** (0-0-6) Cr. 2. F.
Prerequisite: Agricultural Engineering classification.
Principles of wood framing and construction with particular reference to agricultural structures.

359. **Machine Construction.** (0-0-6) Cr. 2. F.
Prerequisite: Chem. 103 or equivalent; Agricultural Engineering or Industrial Education classification.
Oxy-acetylene and electric welding. Chemical and metallurgical principles, selection of equipment, methods of constructing experimental and production machines.

374. **Concrete and Masonry.** (0-1-3) Cr. 2. F.S.
Materials, specifications, and tests; mixtures, forms, reinforcements, uses of concrete on the farm. Other fireproof building materials.

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375. Fundamentals of Agricultural Structures Design. (0-4-3) Cr. 5. F.
Prerequisite: Senior college classification.
The function of buildings in the business of farming. Basic requirements for housing farm animals, crops, etc. Properties and techniques of building materials. Considerations in design. Heat and vapor relationships in farm buildings. Insulation and ventilation.

387. Farm Utilities. (0-2-3) Cr. 3. W.
Prerequisite: Phys. 204.
Lighting, heating, ventilation, water supply, plumbing, sewage disposal, rural electrification.

400. Inspection Trip. Required. F.
Prerequisite: Senior A.E. classification.
An observation trip to centers of industry and engineering construction of interest.

401, 402, 403. Seminar. (0-1-0) Required. Yr.
Preparation, presentation and discussion of papers on agricultural engineering subjects.

410. Farm Safety. (0-1-0) Cr. 1. F.S.
Prerequisite: Senior classification.
Preparation, presentation, and discussion of reports on safety problems of farm people; methods of safety education; safety programs.

425. Soil and Water Conservation Engineering. (0-3-6) Cr. 5. F.
Prerequisite: 224, Agron. 154, T.&A.M. 378.
Meteorology and hydrology as applied to soil and water conservation problems. Flood control projects. Theory of drainage. Drainage and soil conservation districts. Field trips to problem areas.

427. Irrigation. (0-3-0) Cr. 3. W.
Prerequisite: 425.
Water supply, irrigation institutions, irrigation structures, conveyance of water, preparation of land and application of water. Principles of the flow of water through soil. Supplemental irrigation in humid regions.

436. Advanced Farm Machinery. (3-0-3) Cr. 4. W.
Prerequisite: 286, M.E. 315.
Design, development and testing of farm machinery to meet the functional requirements of machines for tillage, seeding, cultivation and weed control, harvesting, crop processing, and farm power units.

447. Agricultural Engineering Applications. (0-3-0) Cr. 3. W.
Prerequisite: 286, 346, T.&A.M. 324.
Summarization, correlation and extension of the agricultural engineering techniques, economic limitations in design and management.

462. Farm Electrification. (0-2-3) Cr. 3. S.
Prerequisite: Credit or classification in E.E. 437.
Selection and use of electrical equipment as related to efficiency and economy of agricultural production, processing and storage of feeds, forage crops and grains in connection with the livestock, poultry and dairy enterprises.

476. Advanced Agricultural Structures Design. (0-3-3) Cr. 4. S.
Prerequisite: 375, T.&A.M. 324.
Wind loads and wind resistant construction. Structural problems in farm buildings. Valuation, appraisal and estimating. Design of major service and processing buildings.

487. Farm Utilities. (0-2-3) Cr. 3. S.
Prerequisite: 375, Phys. 223, M.E. 344.
Analysis of psychrometric data, calculation of heat losses, design of residential heating plants, sanitary equipment, plumbing, waste disposal, lighting standards and sources.

489. Farm Buildings and Equipment. (0-2-3) Cr. 3. F.W.
Prerequisite: Phys. 204.
Plans, materials, construction, lighting, heating, and ventilation of farm buildings; water supply, sewage disposal.

490. Farm Equipment Operation. (0-0-6 to 12) Cr. 2 to 4. F.S.
Prerequisite: 286 or 334.
Practice in the operation of farm machines. Reports of quantity, quality, and cost of work.

491, 492, 493. Dairy Plant Equipment. (D.I. 491, 492, 493) (0-3-3) Cr. 4 each. Yr.
Design, construction and functioning of dairy plant equipment.

496. Advanced Soil and Water Conservation. (0-3-0) Cr. 3. S.
Prerequisite: 306 or equivalent.
Primarily for graduate students in agriculture. Mechanical methods of controlling erosion and providing drainage. Flood control. Irrigation methods. Land measurement. Use of aerial photographs. Field trips to problem areas.

Courses for Advanced Undergraduate and Graduate Students

515. **Teaching Farm Mechanics.** (V.Ed. 515) (0-2-8) Cr. 8. F.W.S.
Prerequisite: 254 and permission of instructor. Mr. Morford
Objectives and methods; equipment and management of the shop; organization of shop program. Students will plan and present demonstrations of methods of teaching mechanical skills.

528. **Special Topics.** Cr. 1 to 5. F.W.S.
A. Soil and Water Conservation. Messrs. Ayres, Frevert
B. Agricultural Machines. Messrs. Beresford, Davidson
C. Agricultural Power. Messrs. Beresford, Davidson
D. Agricultural Structures. Messrs. Beresford, Giese
E. Farm Utilities. Messrs. Beresford, Giese
F. Farm Mechanics. Messrs. Beresford, Morford
G. Rural Electrification. Mr. Beresford

Courses for Graduate Students

628. **Research.** F.W.S.
A. Soil and Water Conservation. Messrs. Ayres, Frevert
B. Agricultural Machines. Messrs. Beresford, Collins, Davidson
C. Agricultural Power. Messrs. Beresford, Collins, Davidson
D. Agricultural Structures. Messrs. Beresford, Giese
E. Farm Utilities. Messrs. Beresford, Giese
G. Rural Electrification. Mr. Beresford

631. **Agricultural Structures and Equipment Engineering.** (0-3-0) Cr. 3. F.
Prerequisite: Graduate classification in engineering. Mr. Giese
Critical analysis of the design and functional relation of farm structures and equipment, including research methods, project planning, and reporting of results.

632. **Advanced Soil and Water Conservation Engineering.** (0-3-0) Cr. 3. W.
Prerequisite: Graduate classification in engineering.
Messrs. Ayres, Beresford, Frevert
Critical analysis of the design and functional relations of soil and water conservation facilities, including experimental techniques.

633. **Agricultural Power and Machinery.** (0-3-0) Cr. 3. S.
Prerequisite: Graduate classification in engineering.
Messrs. Beresford, Collins, Morford
Critical analysis of power and equipment for agricultural production with emphasis on functional design requirements, and techniques for testing and evaluating performance.

661, 662, 663. **Seminar.** (1-0-0) Cr. 1 each. F.W.S.
Discussion of research problems, methods, procedures, and reports. Mr. Beresford

Agricultural Journalism

For description of courses, see Department of Technical Journalism, page 305.

Agriculture

FLOYD ANDRE, Ph.D., Dean of Agriculture

ROY MILTON KOTTMAN, M.S., Assistant Dean

Professors: Louis Milton Thompson, Ph.D.; Russell M. Vifquain, M.S.

Instructor: Skinner

Opportunities for Undergraduate Study

For undergraduate curricula in agriculture, see pages 90 to 110.

For program for herdsmen, see page 109.

For training for extension service, see page 110.

Farm Operation

LOUIS MILTON THOMPSON, Ph.D., In Charge

For undergraduate curriculum in farm operation leading to the degree of Bachelor of Science, see page 101.

The curriculum in farm operation is intended for those students who are looking forward to general farming as their lifework. It is, therefore, designed to develop those understandings, abilities, and attitudes which are essential to (a) efficient farm operation and management, (b) effective participation as a citizen and leader in a rural community, and (c) personal satisfaction and happiness in rural living.

The curriculum is composed essentially of two alternative but related courses of study, both of collegiate grade, namely, a two-year program leading to a certificate, and a four-year curriculum leading to the degree of Bachelor of Science.

Practical Work

Administered by the head of the department in which the student elects to take the work.

Students of the Division of Agriculture must have at least six months of practical experience before graduation. This requirement should be met before the beginning of the junior year. (See Ag. 104.)

Description of Courses

Courses Primarily for Undergraduate Students

101. Orientation. Required. F.
Lectures and class work designed to aid the first-year student to adjust himself to his environment.

104. Practical Work.
A minimum of six months practical work in the student's field of study is required for graduation. This requirement should be met before the beginning of the junior year.

450. Farm Operation. (0-1-6) Cr. 3. F.W.S.
Prerequisite: Senior college classification in Division of Agriculture.
Plans, conferences, decisions, records and reports by students on operation of a practice farm. Trips to farms and markets.

Agronomy

WILLIAM HENRY PIERRE, Ph.D., Head of Department

Professors: Charles Allen Black, Ph.D.; George M. Browning, Ph.D.; Horace Bellatti Cheney, Ph.D.; Lester Earl Clapp, B.S.; Francis Eugene Clark, Ph.D.; Bruce Judson Firkins, M.S.; Max M. Hoover, Ph.D.; Harold DeMott Hughes, M.S.A.; Iver Johannas Johnson, Ph.D.; Don Kirkham, Ph.D.; Hickman Charles Murphy, Ph.D.; Frank F. Riecken, Ph.D.; Joseph L. Robinson, Ph.D.; George Frederick Sprague, Ph.D.; Louis Milton Thompson, Ph.D.; Carroll Paton Wilsie, Ph.D.

Associate Professors: Marvin A. Anderson, M.S.; Richard E. Atkins, Ph.D.; Gerald L. Barger, Ph.D.; William V. Bartholomew, Ph.D.; Charles S. Dorchester, Ph.D.; John C. Eldredge, Ph.D.; Robert Rankin Kalton, Ph.D.; Howard Robert Meldrum, B.S.; Darrel Seymour Metcalfe, Ph.D.; Frank W. Schaller, Ph.D.; Jesse M. Scholl, Ph.D.; Robert H. Shaw, Ph.D.; George Stanford, Ph.D.; Charles Robert Weber, Ph.D.

Assistant Professors: Albert F. Dodge, B.S.; Lloyd Dumenil, M.S.; Edward Samuel Dyas, B.S.; Alfred J. Englehorn, M.S.; James Walter Fitts, M.S.; Ralph Edward Krenzin, M.S.; Philip A. Miller, Ph.D.; John Thomas Pesek, Jr., Ph.D.; Wayne Henry Scholtes, Ph.D.; Albert Duncan Scott, Ph.D.; David William Staniforth, Ph.D.; Richard M. Swenson, Ph.D.; Harvey E. Thompson, Ph.D.; Samuel C. Wiggans, Ph.D.

Instructors: Anderson, Einspahr, Evans, Foth, Gardner, Hanway, Hutchcroft, Nelson, Nicholson, Prill, Robbins, Stritzel, Thomas, Wassom, White, Williams

Opportunities for Undergraduate Study

For undergraduate curriculum in agronomy leading to the degree of Bachelor of Science, see page 96.

The curriculum in agronomy has as its objective training in agriculture with emphasis on the basic principles of crops and soils. Supporting and elective courses are taken in related fields to broaden the student's knowledge in the entire field of agriculture.

Opportunity is provided to meet the diverse interests of students in agronomy through selection of either a broad course of training or several specialized outlines of study. For those students who wish to continue their training in post-graduate study, a special program is outlined to provide additional course work in the sciences basic to either Farm Crops, Soils, or Agro-Climatology. Individually planned programs may be prepared to meet the specific needs of the student.

Graduates in the general course in agronomy are trained to fill positions as county extension directors, farm managers, extension workers, instructors in agricultural colleges, technicians in fertilizer companies and similar commercial organizations. Graduates with specialized training in each of the fields of study listed on page 97 may secure positions in their respective field of specialization. In the field of commercial seed production or seed technology the outline of suggested electives should prepare the student for positions with hybrid seed corn companies and other commercial seed firms or for positions as grain inspectors. Training in the special program for soil conservation planning has been outlined to prepare students for positions in soil conservation. The course of study in soil survey and land appraisal is designed for students who seek positions with state or federal agencies as soil surveyors and with service companies, loaning and other agencies interested in land appraisal.

Graduates from the specialized program for continuation study on the post-graduate level should continue their training to the completion of the master's or doctor's degree. Advanced training will be preparation for positions in research in the several specialized fields of agronomy in state or federal experiment stations, and as specialists in these fields in colleges and universities.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in crop production, crop breeding, soil physics, soil fertility, soil bacteriology, soil morphology and genesis, soil management, and agricultural climatology; major work leading to the degree of Doctor of Philosophy in soil fertility, soil morphology and genesis, soil bacteriology, soil physics, and crop breeding; and minor work to students taking major work in other departments. Crop production, soil management and agricultural climatology may be taken as part of a divided major for the degree of Doctor of Philosophy, with the other part of the major taken in a closely related field.

Prerequisite to major graduate work in farm crops or soils is the completion of an undergraduate curriculum substantially equivalent to that recommended for pre-graduate training in the agronomy curriculum at this institution. See page 96. The completion of the prerequisites listed on page 208 is necessary for major graduate work in agricultural climatology.

In the case of a divided major in agronomy and a related department, prerequisite to graduate work is the completion of an undergraduate program covering the basic courses in the proposed divided fields of specialization .

Open to graduate students for minor only: 414, 415, 438, 454, 455, 464, 465, 473, 474, 485.

Description of Courses

Courses in General Agronomy

Course Primarily for Noncollegiate Students

2. Farm Crop Production and Soil Management. (0-3-2) Cr. 4. W.
Principles of crop production including choice of crops and varieties, selecting and purchasing seed, seedbed preparation, care during growth and harvesting. Brief study of soils, including maintenance of tilth, rotations, manuring, erosion control, liming, and fertilization.

Courses Primarily for Undergraduate Students

100. Technical Lecture. (1-0-0) Required. S.
Survey of different branches of agronomy.

300. Crop Production and Soil Management. (0-6-0) Cr. 3. SS.
For special groups.
Distribution, production, harvesting and utilization of crops; formation, characteristics and classification of soils; principles and practices of soil conservation, fertility maintenance and soil management.

400. Agricultural Travel Course. Cr. 4. Students taking this course will be required to register for A.H. 400 for 4 credits. SS.
Prerequisite: 154.
Tour and study of production methods in major crop and livestock regions of the United States. Influence of climate, soil, topography, markets, and other factors on livestock and crop production and livestock management practices.

Courses in Farm Crops

Courses Primarily for Undergraduate Students

111. Principles of Crop Production. (0-3-0) Cr. 3. F.W.
Fundamental underlying principles of crop production; crop distribution; growth processes and response to environment.

112. Grain Crops. (1-2-2) Cr. 4. W.S.
Prerequisite: 111.
Corn and small grain crops, including their distribution, use, improvement, growth, harvesting and marketing.

114. Crop Production and Management. (0-3-2) Cr. 4. F.W.
For students in Farm Operation and Poultry Husbandry curricula.
Crop adaptation and distribution. Cultural practices and recommended varieties of each of the important farm crops. Factors of importance in the storage and marketing of grain and forage crops. Identification of crop varieties and of important farm weed seeds.

234. Forage Crops. (0-3-0 or 2) Cr. 3 or 4. F.S.
Prerequisite: 112, when required in curriculum.
Study of grasses, legumes, and other plants and their uses as hay, pasture, silage, soiling, and green manure.

238. Crop Seed. (0-2-3) Cr. 3. W.
Prerequisite: 112, 234.
Seed production with emphasis on seed yield, harvesting methods, and storage problems. Selection and judging of seed. Study of morphological characters of crop plants and seeds.

324. Principles of Crop Breeding. (1-2-2) Cr. 4. S.
For students in Farm Operation Curriculum only.
Prerequisite: Genetics 200.
Significance of crop improvement in the maintenance of crop yields. Detailed methods used in grain and forage crop improvements with special emphasis on corn. The role of seed certification in maintenance of varietal purity and the production of quality seed.

338. Seed Analysis. (Bot. 338) See Botany.

411. Seminar. (0-1-0) Cr. 1. F.W.
Prerequisite: 238. Senior classification.
Discussion of current farm crops problems; interpretations of research data.

414. Crop Management. (0-3-0) Cr. 3. W.S.
Prerequisite: 234.
Solution of practical crop problems through application of experimental data.

415. Fiber, Sugar and Oil-seed Crops. (0 2-0) Cr. 2. S.
Prerequisite: 112.
Production and processing of cotton, flax, hemp, sisal and other fibers; production and by-products of oil seeds such as soybeans, flax, cottonseed, etc.; studies of sugar cane, sugar beets and sorghum for syrup.

417. Commercial Crop Grading and Identification. (Ec.417) (0-1-4) Cr. 3. S.
Prerequisite: 238 or Ec. 335.
Grading and identification of cereal and forage crops with particular emphasis on market classes and grades.

438. Seed Viability. (Bot. 438) See Botany.

Courses for Advanced Undergraduate and Graduate Students

514. Crop Adaptation. (0-3-0) Cr. 3. F.
Prerequisite: 234, Gen. 300 and Senior classification. Mr. Wilsie
Adaptation of crop plants and varieties to different environmental conditions and uses; also the influence of selection and breeding.

524. Cereal and Forage Crop Breeding. (3-0-2) Cr. 4. W.
Prerequisite: Gen. 300. Mr. Kalton
Application of principles of genetics and allied subjects to improvement of field crops.

525. Crop Breeding Technique. (0-0-12 to 24) Cr. 2 to 4. SS.
Prerequisite: 524 and permission of instructor. Messrs. Johnson, Kalton
Field methods and practices in cross- and self-pollination of crop plants.

534. Pasture Improvement and Management. (0-3-0) Cr. 3. W.
Prerequisite: 234. Mr. Scholl
Types of pastures and pasture vegetation; methods of establishment and improvement; influence on economy of production and on soil conservation.

538. Seed Borne Pathogens. (Bot. 538) See Botany.

545. Special Topics in Farm Crops. Cr. 2 to 4. F.W.S.
Prerequisite: Quality point average of 2.5 in preceding two quarters and sufficient preparation to benefit from specialized study. Messrs. Hughes, Johnson, Kalton
Literature reviews and conferences on selected topics according to needs and interests of students.

Courses for Graduate Students

621. Advanced Cereal and Forage Crop Breeding. (0-3-0) Cr. 3. F.
Prerequisite: 524, Gen. 630. Mr. Johnson
Basic principles of inbreeding, hybridization, selection, and progeny testing, breeding systems and plans.

622. **Advanced Corn Breeding.** (0-3-0) Cr. 3. W.
Prerequisite: 524, Gen. 630. Mr. Sprague
Corn improvement; basic concepts of inbreeding and selection, testing for combining ability and utilization of inbred lines in the production of corn hybrids.

624. **Advanced Crop Breeding and Research Methods.** (3-0-0) Cr. 3. S.
Prerequisite: 524, Stat. 401. Mr. Johnson
Application of biological principles to crop breeding; interpretation of plot experiments.

640. **Research.** F.W.S.
A. Crop Production. Messrs. Hughes, Johnson, Wilsie
B. Crop Breeding. Messrs. Johnson, Kalton, Murphy, Sprague, Wilsie

645. **Seminar.** (0-1-0) Cr. 1. F.W.S.
Messrs. Hughes, Johnson, Sprague, Wilsie
Reports and discussions of current investigations in crop breeding and crop production.

Courses in Soils

Courses Primarily for Undergraduate Students

154. **Soils.** (0 3-2) Cr. 4. F.W.S.
Prerequisite: Chem. 101
Introduction to problems of soil management, fertility maintenance and erosion control. General principles of formation, classification and occurrence of soils.

354. **Soil Fertility.** (0-3 2) Cr. 4. F.W.S.
Prerequisite: 154, Chem. 255 or 257 or equivalent.
Physical, chemical, and biological properties of soils in relation to fertility maintenance and good soil management. Studies of use of lime, manure, fertilizer.

357. **Forest Soils.** (0-3-0) Cr. 3. W.
Prerequisite: 154.
Physical, chemical, and biological soil factors affecting forest growth and nursery management.

451. **Seminar.** (0-1-0) Cr. 1. W.S.
Prerequisite: 354. Senior classification
Discussion of current soils problems, interpretation of research data.

454. **Soil Management.** (0-3-0) Cr. 3. F.W.S.
Prerequisite: 354.
Application of principles of soil management to solution of practical farm problems.

455. **Soil Management and Fertility Maintenance.** (0-8-0) Cr. 2. Three weeks. Alt. SS. Not offered 1952
Prerequisite: 354. May not be substituted for 454
Review of newer developments in various fields of soil science related to soil management and fertility maintenance.

464. **Soil Conservation and Erosion Control.** (0-2-3) Cr. 3. F.S.
Prerequisite: 154 or equivalent.
Soil conservation practices and their application to specific farm situations on the basis of the physical features of the land. Co-ordination of conservation practices with all phases of an overall farm program. Out of town field trips.

465. **Soil Conservation.** (0 8 0) Cr. 2. Three weeks. Alt. SS. Offered 1952
Prerequisite: 354 or equivalent.
Review of recent work in various fields of agronomy related to soil and water conservation.

478. **Soil Survey.** (2-0 2) Cr. 3. S.
Prerequisite: 154, 354.
Description and identification of soil profiles, techniques of soil mapping, and interpretation of survey data; field trips.

474. **Field Study of Soils.** Cr. 4. Three weeks. Alt. SS. Offered 1952
Prerequisite: 354.
Tour and study of different soil areas of Iowa, with emphasis on the influence of soil characteristics on land use, erosion, fertility and other soil and crop management problems. Visits will be made to the outlying Soil Type Experiment Fields to study research in progress.

485. **Agro-bacteriology.** (3-0-0) Cr. 3. W.
Prerequisite: 154, Bact. 304A
Role of micro-organisms in certain processes and transformations of agronomic interest. Soil microflora and its effect on soil fertility. Legume bacteria and inoculation. Silage preservation. Heating of hay and stored grains. Manure conservation.

Courses for Advanced Undergraduate and Graduate Students

553. **Soil Conditions and Crop Growth.** (3-0-0) Cr. 3. F.
Prerequisite: 354. Mr. Black
Composition and properties of soils in relation to the nutrition and growth of plants.

554. **Fertilizers.** (0-2-0) Cr. 2. S.
Prerequisite: 354. Mr. Swenson
The production and utilization of commercial fertilizers. Out of town field trips.

556. **Laboratory Methods of Soils Investigations.** (0-0-4 to 6) Cr. 2 to 3.
A. Soil Bacteriology. *Prerequisite:* Agron. 585. Alt. S. Offered 1953 Mr. Bartholomew
B. Soil Fertility. *Prerequisite:* Agron. 354, Chem. 212. Alt. F. Offered 1952 Mr. Black
C. Soil Physics. *Prerequisite:* Agron. 577. Alt. W. Not offered 1953. Mr. Kirkham

557. **Soil Chemistry.** (Chem. 557) (2 0 0) Cr. 2. Alt. S. Offered 1953
Prerequisite: 553, Chem. 322. Mr. Scott
Chemical and mineralogical properties of soil colloids. Ion exchange and soil reaction.

565. **Advanced Soil Management and Conservation.** (3-0 0) Cr. 3. W.
Prerequisite: 464, 473, A.E. 306. Mr. Pierre
Fundamental principles involved in the management, improvement and conservation of soils.

575. **Soil Genesis and Classification.** (3-0-0) Cr. 3. W.
Prerequisite: 553, Geol. 375 or 202. Mr. Riecken
Processes of formation, systems of classification, and geographical distribution of soils.

577. **Soil Physics.** (Phys. 577) (3-0-0) Cr. 3. F.
Prerequisite: 154 or permission of instructor. Mr. Kirkham
Relation of physical properties of soils to plant growth, conservation practices and land utilization. Particle-size distribution, soil structure, clay minerals, soil moisture, rheological properties and soil temperature.

585. **Soil Bacteriology.** (Bact. 585) (3-0-0) Cr. 3. W.
Prerequisite: 354, Bact. 304A or permission of instructor. Mr. Bartholomew
Occurrence and activities of soil microorganisms and influence of soil population on fertility.

596. **Special Topics in Soils.** (Bact. 596A) Cr. 2 to 4. F.W.S.
Prerequisite: 15 credits in Agronomy and permission of instructor.
Messrs. Bartholomew, Black, Firkins, Kirkham, Pierre, Riecken, Scott, Stanford
Literature reviews and conferences on selected topics according to needs and interests of students.

Courses for Graduate Students

655. **Advanved Soil Fertility.** (3-0-0) Cr. 3. Alt. W. Offered 1953
Prerequisite: 553. Mr. Pierre
Chemistry of soil-plant relationships; theory and practice in use of fertilizers.

675. **Advanced Soil Genesis and Classification.** (0-2-0) Cr. 2
Alt. S. Not offered 1953
Prerequisite: 575. Mr. Riecken
Theories of podzolization, calcification, and other soil-forming processes; principles of soil classification.

677. **Advanced Soil Physics.** (Phys. 677) (3-0-0) Cr. 3.
Alt. S. Offered 1953
Prerequisite: 577, Math. 212. Mr. Kirkham
Physical characteristics of soils and principles underlying flow and distribution of water in soils.

685. **Advanced Soil Bacteriology.** (Bact. 685) (3-0-0) Cr. 3
Alt. S. Not offered 1953
Prerequisite: 585. Mr. Bartholomew
Nature of microbiological population of soil, and biochemical transformations brought about by soil microorganisms.

690. **Research.** F.W.S.
A. Soil Bacteriology. (Bact. 690A.) Messrs. Bartholomew, Clark
B. Soil Fertility. Messrs. Black, Pierre, Stanford
C. Soil Physics. (Phys. 690). Mr. Kirkham
D. Soil Management. Messrs. Firkins, Pierre, Stanford
E. Soil Morphology and Genesis. Mr. Riecken

695. **Seminar.** (0-1-0) Cr. 1. (Bact. 695) F.W.S.
Messrs. Bartholomew, Black, Kirkham, Pierre, Riecken, Stanford
Reports and discussions on current investigations in soil science.

Courses in Agricultural Climatology

Courses Primarily for Undergraduate Students

206. **Agricultural Meteorology.** (3-0-0) Cr. 3 F.
Introduction to basic meteorological processes related to agriculture. Study of weather maps and forecasting.

Course Primarily for Advanced Undergraduate and Graduate Students

505. Plant Climate. (3-0 0) Cr. 3. W.
Prerequisite: 354, Phys. 204, Bot. 205. Mr. Shaw
The heat exchange near the ground. Relation of topography and plant cover to the micro-climate. Modification of micro-climate by agricultural operations.

506. Methods in Climatology. (3-0-0) Cr. 3. S.
Prerequisite: 505, Phys. 384, Stat. 448. Mr. Shaw
Physical and statistical processes in the study of the climate and the analysis of agro-climatic data.

Courses for Graduate Students

606. Research in Agro-climatology. F.W.S.
Consultation with instructor, exhaustive examination of the literature pertaining to and original thought on a special research problem of special interest to the student.

609. Conference in Agro-climatology. (0-1-0) Cr. 1. F.W.S.
Consultation with instructor, special problems and/or reading assigned in consultations with the instructor on which the student reports.

Air Science

For description of courses, see Department of Military Science, page 280.

Animal Husbandry

PHINEAS STEVENS SHEARER, M.S., Head of Department

Professors: Arthur Lawrence Anderson, M.S.; Floyd Jay Arnold, M.S.; Rex Beresford, B.S.A.; *Clawson Young Cannon, Ph.D.; W. A. Craft, Ph.D.; Charles Calvin Culbertson, M.S.; Lanoy N. Hazel, Ph.D.; William F. LaGrange, M.S.; Jay Lawrence Lush, Ph.D.; Robert M. Melampy, Ph.D.; Arthur R. Porter, M.S.; Robert G. Tischer, Ph.D.

Associate Professors: Wise Burroughs, Ph.D.; Damon von Catron, Ph.D; Norman Leonard Jacobson, Ph.D; Roy Milton Kottman, M.S.; Elvin L. Quaife, B.S.; Clair W. McDonald, M.S.

Assistant Professors: Robert Scott Allen, Ph.D.; Gordon Clemence Ashton, M.S.; Joseph Kastelic, Ph.D.; James J. Kiser, B.S.; Edwin A. Kline, M.S.; Lon D. McGilliard, M.S.; Richard M. McWilliams, M.S.; Alfred L. Musson, Ph.D.; George E. Stoddard, Ph.D.; Donald Edward Voelker, M.S.

Instructors: Anderson, Cheng, Francis, Maddock, Story, Young, Zaletel

Opportunities for Undergraduate Study

For undergraduate curricula in animal husbandry and dairy husbandry, leading to the degree of Bachelor of Science, see pages 98 and 99.

The curricula in animal husbandry and dairy husbandry provide general training in the field of agriculture with special emphasis on the production of livestock and livestock products. Opportunity is offered for students to major in general animal husbandry or dairy husbandry through a choice of options in the junior and senior years. The curricula provides a liberal allowance of elective credits to be filled with courses selected by the student.

Students graduating from these curricula with their various options find employment in many lines of work some of which are: directors of county extension work; extension associates in youth activities; managers of general livestock or dairy

*On leave

farms; fieldmen for farm management or insurance companies; management, buying, sales, or supervisory positions with meat packing, produce, feed, creamery and farm equipment companies; positions with various agencies of the United States Department of Agriculture. The curricula have been adapted to train young men who expect to return to the farm and engage in general or specialized livestock or dairy production. Opportunities in college teaching and research are available to graduates of these curricula, but usually require graduate training.

The two-quarter program for herdsmen is designed to meet the needs of young men who are primarily interested in livestock. Opportunity is afforded the students for some specialization in the class of livestock in which they are most interested. This program is most practical in nature and includes sufficient general work in agriculture to fit men for general livestock farming, dairy farming, herd management, or dairy-herd improvement association supervision. It is intended for the young man who is unable to enter the regular four-year curricula or who wants a short practical preparation for some special vocation. Instruction will be offered in two periods; the first from January to March, 1952, the second from January to March the year following. The students are expected to spend the time between the two periods gaining additional experience in their chosen line. Upon satisfactory completion of the second period, a statement will be granted certifying the student has completed the program.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in animal nutrition, animal production, animal breeding, meats and dairy husbandry; major work for the degree of Doctor of Philosophy in animal breeding, animal nutrition, and dairy husbandry; and minor work to students taking major work in other departments.

The fields of major work listed above will include courses listed in other departments when such courses are appropriate to the student's previous training, major interests, and thesis problem. Thus, those taking major work in all the above fields will often include courses in mathematics (statistical methods); those taking major work in animal breeding will include courses in genetics and zoology; and those taking major work in animal nutrition will include courses in physiology and chemistry.

Prerequisite to major graduate work is the completion of an undergraduate curriculum in animal husbandry or dairy husbandry, substantially equivalent to one of those required of undergraduate students at this institution and including prerequisite undergraduate courses necessary for the particular field chosen. The student should have a general knowledge of zoology and both inorganic and organic chemistry.

Open to graduate students for minor only: 319, 350, 400, 403, 425, 427, 429, 430, 431, 434, 460, 475, 490.

Description of Courses

Courses Primarily for Noncollegiate Students

20. Production and Feeding of Livestock. (0-8-0) Cr. 8. W.
Prerequisite: 28.
Feeding of different classes of livestock for market production.

21. Types and Market Classes of Livestock. (0-0-6) Cr. 3. W.
Judging, types, carcasses, markets and market classification.

22. Breed Studies. (0-2-4) Cr. 4. W.
Prerequisite: 21.
Breeds of livestock, their use and adaptability in commercial production.

28. **General Livestock Feeding and Management.** (0-3-3) Cr. 4. W.
Feed stuffs, compounding and balancing rations, practical care, feed and management of livestock.

29. **Market Classes and Grades of Livestock and Livestock Products.** (0-0-3) Cr. 2. W.
Prerequisite: 21.
Classifying, grading, and valuing of cattle, sheep, hogs, and livestock products.

30. **Dairy Herd Improvement.** (0-0-4) Cr. 2. W.
Training in keeping dairy records and in supervising a Dairy Herd Improvement Association.

51. **Animal Breeding.** (0-2 0) Cr. 2. W.
Principles of livestock breeding, selection and improvement of herds and flocks.

71. **Farm Meats.** (0-0-6) Cr. 2. W.
Prerequisite: 21.
Selecting and slaughtering of meat animals; cutting and curing of farm meats.

Courses Primarily for Undergraduate Students

104. **Livestock Problems.** (0-1-8) Cr. 2. F.
For Dairy Industry Students
Selection, judging, breeding, and management of dairy cattle.

110. **Technical Lecture.** (1-0-0) Required. S.
Survey of animal husbandry field.

111. **Livestock Problems.** (0-1-4) Cr. 3. F.
Relation of livestock to agriculture and human welfare. Beef cattle and sheep. Selection, judging, carcass studies, markets, market classifications, breeding and management.

112. **Livestock Problems.** (0-1-4) Cr. 3. S.
Hogs. Selection, judging, carcass studies, markets, market classifications, breeding and management. Dairy cattle. Selection, judging, breeding and management.

115. **Livestock Problems.** (0-1-2) Cr. 2. W.
Breeds of horses for farms and pleasure. Selecting, judging, breeding, management and marketing.

125. **Livestock Management.** (0-1-3) Cr. 2. F.S.
Practical problems in handling farm livestock.

135. **Dairy Cattle Feeding and Management.** (0-3-0) Cr. 3. W.
For students in dairy plant operation Feeding standards and their applications; dairy herd management practices.

205. **Breeds of Livestock.** (0-1-6) Cr. 4. F.
Prerequisite: 111, 112.
Their use and adaptability in commercial livestock production.

211. **Breeds of Livestock.** (0-1-4) Cr. 3. F.
Prerequisite: 111, 112.
Breeds of dairy cattle and sheep, their use and adaptability in commercial livestock production.

212. **Breeds of Livestock.** (0-1-4) Cr. 3. W.
Prerequisite: 111, 112.
Breeds of beef cattle and hogs, their use and adaptability in commercial livestock production.

216. **Livestock Feeding and Management.** (0 3-0) Cr. 3. F.W.
Prerequisite: 111 or 112.
Not for students in Animal Husbandry or Dairy Husbandry curricula. Not open to those who have credit in 415 or 416.
Practical feeding and management of hogs, beef and dairy cattle, and sheep.

254. **Principles of Breeding.** (0-3-0) Cr. 3. S.
Prerequisite: 111, 112, Gen. 200 or 300.
Physical basis of heredity; Mendelism; livestock breeding.

270. **Meats.** (2-0-3) Cr. 3. W.S.
Prerequisite: 111, 112, Vet.Anat. 217.
Comparative studies of meat animals and carcasses; slaughtering meat animals; cutting, grading, identifying, curing and freezing meat.

305. **Livestock Judging.** (0-0-6) Cr. 2. F.
Prerequisite: 115, 211, 212 and Vet.Anat. 217.
Horses, beef cattle, sheep, and hogs.

310. **Horses.** (0-2-3) Cr. 3. S.
Prerequisite: 115, 216 or 318.
Breeds of horses; anatomy, physiology, breeding, care, feeding and management. Judging, selection and handling. Field trips.

316. **General Livestock Production.** (3-0-6) Cr. 3. SS.
For special groups. Relation of livestock to agriculture and to human needs. Selection, judging, carcass studies, breeding, feeding, management, market grades and market classes.

318. **Fundamentals of Nutrition.** (3-0 0) Cr. 3. F.W.S.
Prerequisite: Chem. 255 or equivalent.
Introduction to carbohydrates, proteins, lipids, inorganic nutrients and vitamins.

319. **Applied Animal Nutrition.** (P.H.319) (0-2-3) Cr. 3. W.S.
Prerequisite: 318, Chem. 256, Vet. Phys. 364.
Essential nutritive requirements of livestock and poultry; sources and composition of nutrients; biological and replacement value of feeds in rations; identification of ingredients; mixing and preparation of feeds.

335. **Dairy Cattle Judging.** (0-0-6) Cr. 2. S.
Prerequisite: 211, V.Anat. 217.
Judging and selection of breeding animals. Trips to dairy cattle farms.

337. **Dairy Cattle Feeding and Management.** (0-3-0) Cr. 3. F.
Prerequisite: Chem. 264B.
For dairy industry students. Feeding, care, management, and development of dairy cattle; methods of milk production.

350. **Animal Breeding.** (3-0-0) Cr. 3. W.S.
Prerequisite: 211, 212, Gen. 300.
Application of principles of genetics to improvement of farm animals; breeders' methods and problems.

360. **Dairy Cattle Breed Studies.** (0-2-0) Cr. 2. S.
Prerequisite: 211, credit or classification in 350.
Pedigree writing and interpretation; official testing; show ring classes; type classification and records for purebred herds.

374. **Meats.** (1-0-2) Cr. 2. F.S.
For Home Economics students.
Selecting, grading, identifying, curing and freezing meats.

400. **Agricultural Travel Course. Cr. 4. (Agron. 400, cr. 4 also required for students taking this course.)** SS.
Prerequisite: 111, 112.
Tour and study of production methods in major livestock and crop regions of the United States. Influence of climate, soil, topography, markets, and other factors on livestock and crops produced. Livestock management and crop production practices.

403. **Marketing Livestock and Meat.** (Ec. 403) See Economics.

405. **Advanced Livestock Judging.** (0 0-6) Cr. 2. S.
Prerequisite: 305.
Horses, beef cattle, sheep, and hogs. Trips to shows and stock farms.

409. **Market Classes and Grades of Livestock.** (0-2-0) Cr. 2. F.S.
Prerequisite: 111, 112, Vet.Anat. 217.
Classifying, grading, and valuing horses, cattle, sheep, and hogs from standpoint of market.

415. **Livestock Production.** (0 3-0) Cr. 3. W.S.
Prerequisite: 318.
Not for students in Animal Husbandry or Dairy Husbandry curricula. Fundamentals of nutrition applied to livestock feeding. Management of herds and flocks. Composition and digestibility of feeding stuffs; feeding standards and calculation of rations for beef cattle and sheep.

416. **Livestock Production.** (0-3-0) Cr. 3. W.S.
Prerequisite: 318.
Not for students in Animal Husbandry or Dairy Husbandry curricula. Fundamentals of nutrition applied to livestock feeding. Management of herds Composition and digestibility of feeding stuffs; feeding standards and calculation of rations for dairy cattle and hogs.

425. **Swine Production and Marketing.** (0 3-0) Cr. 3. W.S.
Prerequisite: 319, Vet.Phys. 364.

427. **Beef Cattle Production and Marketing.** (0-3-0) Cr. 3. W.S.
Prerequisite: 319, Vet.Phys. 364.

429. **Sheep Production and Marketing.** (0-2-0) Cr. 2. F.S.
Prerequisite: 319, Vet.Phys. 364.

430. **Special Problems in Dairy Husbandry.** Cr. 1 to 3. F.W.S.
Open to students in dairy husbandry showing satisfactory preparation for problems chosen and quality point average of 2.5 or above for two preceding quarters. Individual topic, conferences, and preparation of report.

431. **Insemination of Farm Animals.** (2-0-3) Cr. 3. F.S.
Prerequisite: Vet.Anat. 217, Vet.Phys. 364.
Development, organization and management of artificial breeding associations. Physiology of spermatozoa, with emphasis on technique of collection, processing of semen, and methods of insemination.

434. **Milk Production and Herd Management.** (0-2-0) Cr. 2. F.W.
Prerequisite: 318.
For animal husbandry students.
Not open for credit to those who have credit in 135 or 337.
Preparation of feeds; computing rations for milking herd, young stock, and sire. Management of specialized and general dairy farms.

485. Advanced Dairy Cattle Judging. (0-0-6) Cr. 2. F.
Prerequisite: 385.
Training in dairy cattle judging and reasons. Trips to dairy farms and shows. Open only to approved students.

460. Livestock Records. (3 0-0) Cr. 3. F.W.
Prerequisite: 211, 212, credit or classification in 350.
Historical role and current activities of pedigree recording associations. Study of pedigrees and other records needed for the genetic improvement of livestock.

475. Meats and Meat Products. Cr. 1 to 3. F.W.S.
Prerequisite: 270 or 374.
Problems involved in selection, grading, purchasing, and handling of meat.

490. Special Problems in Animal Husbandry. Cr. 1 to 3. F.W.S.
Open to senior college students in animal husbandry showing satisfactory preparation for problems chosen and quality point average of 2 5 or above for two preceding quarters. Individual topic, conferences, and preparation of report.

Courses for Advanced Undergraduate and Graduate Students

505. Advanced Non-Ruminant Nutrition. (3 0-0) Cr. 3. W.
Prerequisite: 319, Chem. 474. Mr. Catron
Nutrition requirements for maintenance, growth, fattening, reproduction and lactation in the non-ruminant animal.

506. Advanced Ruminant Nutrition. (3 0-0) Cr. 3. F.
Prerequisite: 319, Chem. 474 Messrs Burroughs, Stoddard
Digestion, absorption and metabolism of nutrients as related to maintenance, growth, lactation and reproduction in ruminants

535. Milk Secretion. (2 0-3) Cr. 3. F
Prerequisite: 318, Vet.Phys. 364. Mr. Jacobson
Development, structure and functional processes of the mammary gland.

536. Dairy Farm Problems. (3-0-0) Cr. 3. W.
Prerequisite: 318, 350. Mr. Cannon
Production of milk; care, feeding, housing and management of dairy cattle with experimental results and their application to dairy husbandry.

589. Dairy Husbandry Seminar. Cr. 2. W.
For seniors. Selected subjects; recent investigations Messrs. Jacobson, Stoddard

Courses for Graduate Students

603. Seminar in Animal Nutrition. (P H 603) (0 1 0) Cr. 1. F.W.S.
Prerequisite: Permission of instructor Messrs Burroughs, Catron, Jacobson, Johnson

604. Modern Views of Animal Nutrition. (P H 604) (0 2 0) Cr. 2. Alt. W.
Offered 1953
Messrs. Burroughs, Catron, Jacobson, Johnson
Prerequisite: One course in Statistics, P H 504, or A H 505 or 506.
Concepts and trends in non ruminant, ruminant and poultry nutrition.

605. Methods and Techniques in Animal Nutrition Experimentation. (P.H. 605)
See Poultry Husbandry

606A. Institution Purchasing. (I Mgt. 606A, P H 606A) (0-1-6) Cr. 3.
Alt. Yr. Not offered 1952-53
Prerequisite: 374, I Mgt 484 Messrs Kastelic, Kline, Phillips
Meats and poultry.

630. Dairy Husbandry Experimentation. Cr. 1. F.
Experimental methods, criticism of problems. Mr. Jacobson

654. Genetics of Breed Improvement. (Gen. 654) (3-0 0) Cr. 3. W.
Prerequisite: Gen. 300, Stat. 401. Mr. Lush
Genetic structure of breeds or other populations. Effects of gene number, degrees of dominance, gene interaction, linkage, mutations, non-genetic factors. Conditions of equilibrium. Rates of change in population mean or variability. Effects of mass selection.

655. Breeding Systems and Plans. (Gen. 655) (3-0-0) Cr. 3. S.
Prerequisite: 654. Mr. Lush
Inbreeding and outbreeding, assortive mating, progeny testing, selection on family basis, selection indices, records of performance, methods of estimating heritability, comparison of various breeding plans.

680. Seminar. Cr. 1. F.W.S.
Messrs. Hazel, Jacobson, Lush

690. Research.
A. Animal Breeding. Messrs. Hazel, Lush
B. Animal Nutrition. Messrs. Burroughs, Catron
C. Animal Production. Messrs. Anderson, Culbertson, Shearer
D. Dairy Husbandry. Mr. Jacobson
E. Meats. Mr. Kastelic

Applied Art

MARJORIE STUART GARFIELD, M.F.A., Head of Department

Professor: Edna O'Bryan, B.A.

Associate Professors: Mabel C. Fisher; Edna Patzig Gouwens; Gladys E. Hamlin, M.A.; Christian Petersen; Mable Russell, M.S.; Alice Helen Waugh, B.S.

Assistant Professors: Harriet Adams, M.A.; June C. Brown, B.S.; Alice Davis, M.F.A.

Instructors: Fidlar, Graff, Kunau, Monroe, Navin, Schonhorst

Opportunities for Undergraduate Study

For undergraduate curriculum in applied art leading to the degree of Bachelor of Science, see page 131.

The department offers instruction in the use of materials, art elements and design principles, applicable to the needs of the individual, the home, and the community.

Students majoring in applied art, if educational requirements are met, may secure positions as teachers and extension specialists. The commercial field offers positions as assistants in house furnishing, designing, and window display work.

Before promotion to the senior college, permission of the head of the department must be secured by those who propose to continue as majors in applied art. Special ability in art ordinarily will be apparent as the student works in the beginning courses in the department; hence marks of less than B in junior college courses indicate that such students should not continue applied art as their major.

Advance credit students are requested to bring representative work if they expect to receive credit for it.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of undergraduate work in applied art substantially equivalent to that required in the undergraduate curriculum in applied art at this institution.

Open to graduate students for minor only: 305, 434, 445, 464.

Description of Courses

Courses Primarily for Undergraduate Students

103. Basic Design. (1-0-8) **Cr. 4.** **F.W.S.**
Creative problems in design and color with emphasis on art elements and principles.

211, 212. Freehand Drawing and Painting. (0-0-6) **Cr. 2 each.** **F.W.**
Prerequisite: 103. For nonmajors.
(211) Freehand perspective; still life, furniture and interiors. Life drawings; the costumed figure. Pencil, charcoal, pen and ink. (212) The human figure in a wide range of costumes. Water color and tempera.

231, 232, 233. Drawing and Composition. (0-0-6) **Cr. 2 each.** **Yr.**
Prerequisite: 103.
(231) Introduction to drawing; freehand perspective, still life and outdoor sketching. (232) Perspective drawings and pictorial composition. (233) Still life and landscape painting in water color.

260. House Planning. (0-0-6) **Cr. 2.** **F.W.S.**
Prerequisite: 103.
Use of space within the house planned for comfort, economy and beauty. Historic styles and their relation to modern design.

264. Basic Interior House Design. (1-0 6) Cr. 3. F.W.S.
Prerequisite: 103.
Design and color applied to the interior of the house; historic styles.

305. Advertising Design. (0 0 6) Cr. 2. F.W.
Prerequisite: 103.
Lettering and design in dark and light and in color with mediums suitable for reproduction.

324. Life Drawing. (0-0-6) Cr. 2. W.
Prerequisite: 103, 231, 232, 233
Drawing of the figure and head in different media. Artistic approach to anatomy.

344. Constructive and Decorative Design. (0 0-6) Cr. 2. F.W.S.
Prerequisite: 103.
Design in weaving and modern accessories in wood.

345. Craft Design. (0-0-6) Cr. 2. F.W.S.
Prerequisite: 103.
Design with a variety of craft materials· metal, felt, leather, plastic, etc.

393. Sculptural Design. (0-0 6) Cr. 2. F.W.S.
Prerequisite: 103.

400. Special Problems. F.W.S.
Prerequisite: 12 credits in Applied Art.
A. Composition and painting.
B. Design for textiles.
C. Weaving, wood, metals, and other materials.
D. Sculptural design.
E. House planning, or interior house design.
F. Advertising art.

434. Textile Design. (0-0-6) Cr. 3. F.W.S.
Prerequisite: 103, T.&C. 204.
Tie-dyeing, batik, block-printing, stenciling, and stitchery. Modern textile designers and their work.

445. Advanced Constructive and Decorative Design. (0-0-6) Cr. 2. F.S.
Prerequisite: 344, 345.
Weaving, wood, and other materials.

464. Intermediate Interior House Design. (1-0-6) Cr. 3. F.W.
Prerequisite: 264.
Media for the interior designer, including fabric classifications, room planning and interior renderings.

484. Survey of Art. (3-0-0) Cr. 3. F.W.S.
Prerequisite: 103.
Survey of architecture, sculpture, and painting from prehistoric to modern times with emphasis on appreciation.

Courses for Advanced Undergraduate and Graduate Students

500. Advanced Design. Cr. as arranged. F.W.S.
Prerequisite: 12 credits in Applied Art.
A. Composition and painting. Miss Garfield
B. Design for textiles. Miss O'Bryan
C. Weaving, wood, metals, and other materials. Miss Fisher
D. Sculptural design. Mr. Petersen
E. House planning, or interior house designs. Miss Russell
F. Advertising art. Miss O'Bryan

504. Seminar. Cr. as arranged. W.
Prerequisite: 12 credits in Applied Art. Miss Garfield
Required of all advanced undergraduate and graduate students.

507. Design in Lettering. (0-0-6) Cr. 2. W.S.
Prerequisite: 305. Miss O'Bryan
Manuscripts, decorative motifs, and modern alphabets, with emphasis on spacing and technique.

524. Painting and Composition. (0-0-6) Cr. 2. F.S.
Prerequisite · 233. Miss Garfield
Simplification and reorganization of original sketches, with emphasis on creative expression. Medium: water color, tempera, and oil.

535. Advanced Textile Design. (0-0-6) Cr. 2. W.S.
Prerequisite: 434 Miss O'Bryan
Creative design in various mediums appropriate for use, with emphasis on composition, color and technique.

546. Jewelry Design and Construction. (0-0-6) Cr. 2. W.S.
Prerequisite: 344, 345. Miss Fisher
Creating new forms in jewelry using plastics, precious and semi-precious metals and stones

565. **Advanced Interior House Design.** (1-0-6) Cr. 3. S.
Prerequisite: 464. Miss Garfield
Adaptations of traditional and contemporary furnishings to present interior needs. Comprehensive interior design, budgeting and planning of professional nature.

585. **Medieval and Renaissance Art.** (2-0-0) Cr. 2. W.
Prerequisite: 484. Miss Hamlin
Architecture, painting and sculpture from the fall of the Roman Empire through the Renaissance.

586. **Modern and Contemporary Art.** (2-0-0) Cr. 2. S.
Prerequisite: 484, 585. Miss Hamlin
Architecture, painting and sculpture of the 18th, 19th and 20th centuries.

Courses for Graduate Students

605. Special Topics. F.W.S.
Miss Garfield

614. Research. F.W.S.
Miss Garfield

Architecture and Architectural Engineering

THOMAS KEVIN FITZPATRICK, M.Arch., Head of Department

Professors: Lawton Mikell Patten, B.Arch.; John Weber, Jr., M.S.; Leonard Wolf, M.S.

Associate Professors: Roscoe Orrin Lorenz, B.A.; Clair Benjamin Watson, M.F.A.

Assistant Professors: Arthur E. Burton, M.S.; Richard Duncan McConnell, M.S.

Instructors: McKeown, Slater, Stone

Opportunities for Undergraduate Study

For the undergraduate curriculum in architecture leading to the degree of Bachelor of Architecture, see page 117.

The curriculum in architecture is designed to prepare young men and women for professional careers as architects. Its major aim is to prepare the student for efficient service as a draftsman or designer in an architectural organization and to provide him with the necessary foundation to progress ultimately to independent architectural practice in accordance with the professional registration laws of the various states. Upon completion of the third year only those students who have demonstrated superior ability in design will be recommended by the staff to pursue the curriculum leading to the Bachelor of Architecture degree.

For undergraduate curriculum in architectural engineering leading to the degree of Bachelor of Science, see page 118.

The curriculum in architectural engineering is designed to provide the graduate with the necessary background in the fundamentals of architectural design as well as thorough training in structural design sufficient to enable him to solve engineering problems encountered in the general field of building design and construction. The training aims to prepare the graduate to enter such phases of the general field of the building industry as building construction, contracting and maintenance, steel and concrete design, promotion and research in the fields of engineering materials and processes, while maintaining at all times a sympathetic understanding of the problems of architectural design.

All drawings and designs made by students become the property of the department, to be retained, published, exhibited or returned at the discretion of the department.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in architectural engineering, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of a standard curriculum in architectural engineering substantially equivalent to that required of undergraduates at this institution.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: Arch 412; Arch E. 413, 414, 423, 425, 426, 427.

Description of Courses

Courses in Architecture

Courses Primarily for Undergraduate Students

100. Technical Lecture. (1-0-0) Required. S.

103. Architectural Drawing. (0-0-9) Cr. 3. S.
Prerequisite: E.Dr. 132.
Introduction to architectural drawing, perspective, shades and shadows and freehand sketching.

114. Freehand Drawing. (0-0-6 to 12) Cr. 2 or 4. F.W.S.
Beginning drawing and sketching in pencil and charcoal from studio and outdoor objects. Study of proportion, perspective and form.

117. Freehand Drawing. (0-0-6 to 12) Cr. 2 or 4. F.W.S.
Prerequisite: 114 (2 crs)
Elements of composition and color theory. Studio and outdoor problems in water color and black and white.

121, 122, 123. Freehand Drawing. (0-0 6 to 12) Cr. 2 to 4 each. F.W.S.
Prerequisite: 117 (2 crs.)
Water color painting from landscape, models and still life

200. Seminar. (1-0-0) Required. F.
Historical survey of American architecture

201. Architectural Design and Sketching. (0-0-15) Cr. 5. F.
Prerequisite: 103.
Introduction to architectural design with particular emphasis on problems involving small buildings of wood frame and light masonry construction Introduction to pencil sketching.

202. Architectural Design and Sketching. (0-0-15) Cr. 5. W.
Prerequisite: 201.
Continuation of 201. Introduction to pen and ink sketching.

203. Architectural Design and Theory of Color. (0-0-15) Cr. 5. S.
Prerequisite: 202.
Continuation of 202. Study of the theory of color.

304, 305, 306. Architectural Design. (0-0-12) Cr. 4 each. Yr.
304. *Prerequisite:* 203.
305. *Prerequisite:* 304.
306. *Prerequisite:* 305.
More advanced problems in architectural design with particular emphasis on planning and the study of circulation. Consideration of more advanced structural techniques and the broader use of materials.

324. Freehand Drawing. (0-0-6 or 12) Cr. 2 or 4. W.S.
Prerequisite: 114.
Pen and ink drawing and sketching. Original drawings made from studio and outdoor assignments.

325. Freehand Drawing. (0 0 6 or 12) Cr. 2 or 4. F.W.S.
Prerequisite: 114.
Advanced pencil sketching.

326. Applied Delineation. (0-0-6 or 12) Cr. 2 or 4. W.S.
Prerequisite: 114.
Etching, lithography, and block printing and air brush techniques.

334. Domestic Architecture. (2-0-0 or 3) Cr. 2 or 3. F.
Principles of planning and design of small houses with consideration given to materials, methods of construction and equipment.

335. Domestic Architecture. (2-0-0 or 3) Cr. 2 or 3. W.
Principles of planning and design of large houses and country homes.

336. **Housing.** (2-1-0) Cr. 3. S.
Prerequisite: Senior college classification.
Principles of planning and design of group or multiple housing with consideration given to social, economic and political aspects of this problem.

351, 352, 353. **History of Architecture.** (3-0-0) Cr. 3 each. Yr.
Prerequisite: 203.
Historical study of the evolution of architectural forms and their relation to and influence on American architecture.

400. **Senior Inspection Trip.** Required. F.
Prerequisite: Senior Arch. or Arch E. classification
Visits to buildings under construction and building material manufacturing plants for one week.

408. **History of Sculpture and Painting.** (3-0 0) Cr. 3. F.W.S.
Historical survey of sculpture and painting as related to architecture.

410. **Seminar.** (0-1-0) Required. S.
Prerequisite: Senior Arch. or Arch E. classification
Prepared discussions of architectural problems or related subjects

412. **Specifications and Estimating.** (3-0-6) Cr. 5. S.
Prerequisite: Senior or graduate classification.
Writing of architectural specifications; duties and responsibilities of the architect from the professional standpoint; methods of estimating construction costs.

416, 417, 418. **Architectural Design, Advanced Sketching and Color.** (0-0-21) Cr. 7 each. F.W.S.
Prerequisite: 306 and C.E. 331.
Problems in the design of large buildings involving more complex requirements of planning and equipment.
Problems studied in collaboration with Architectural Engineering students.

Courses for Advanced Undergraduate and Graduate Students

521, 522. **Architectural Design and Advanced Sketching.** (0-0 21) Cr. 7 each. F.W.
Prerequisite: 418 and L.A. 401. Mr. FitzPatrick
Continuation of 418 with emphasis on problems concerning the analysis of group planning of related buildings. Presentation drawings supplemented by scale models.

523. **Architectural Office Practices.** (0-0-21) Cr. 7. S.
Prerequisite: Arch. 522 and credit or classification in Arch. 412.
Office organization and preparation of working drawings. Mr. Wolf

Courses in Architectural Engineering

Courses Primarily for Undergraduate Students

413. **Design Analysis.** (0-0-15) Cr. 5. F.
Prerequisite: 306 and C.E. 331.
Analysis of architectural design as affected by structural and mechanical considerations.

414. **Design and Analysis.** (0-0-15) Cr. 5. W.
Prerequisite: 413.
Continuation of 413 with consideration of more advanced problems.

423. **Architectural Office Practice.** (0-0-15) Cr. 5. S.
Prerequisite: 414 and credit or classification in 412.
Office organization and preparation of working drawings.

425, 426, 427. **Special Problems in Architecture and Architectural Engineering.** (0-0-9 to 15) Cr. 3 to 5 each. F.W.S.
Prerequisite: Senior or graduate college classification, permission of department head.
Investigation of problems of special interest to the student.

Courses for Graduate Students

600. **Advanced Design Analysis.** Cr. 1 to 15. F.W.S.
Mr. FitzPatrick

604. **Research.** Mr. FitzPatrick

620. **Seminar.** Required. Mr. FitzPatrick

Bacteriology

CHESTER HAMLIN WERKMAN, Ph.D., D.Sc., Head of Department

Professors: Ival Arthur Merchant, Ph.D.; Frank Eugene Nelson, Ph.D.; Fritz Schlenk, Ph.D.

Associate Professors: John C. Ayres, Ph.D.; Wm. B. Bartholomew, Ph.D.

Assistant Professors: Eric Beaumont Fowler, Ph.D.; Loyd Yost Quinn, Ph.D.; Stanley Kallick Shapiro, Ph.D.; Keith H. Steinkraus, Ph.D.

Instructors: Bell, Claridge, Hurley, Nelson, Wessman

Opportunities for Undergraduate Study

For undergraduate curriculum in science, major in bacteriology, leading to the degree of Bachelor of Science, see page 144. Physics 213 or equivalent, Chemistry 333, and Chemistry 211 or equivalent are required of all majors in Bacteriology.

Students who specialize in this department receive fundamental training in general and technical bacteriology such as will fit them to be agricultural bacteriologists, soil bacteriologists, dairy bacteriologists, veterinary bacteriologists, industrial bacteriologists, food bacteriologists, sanitary bacteriologists, and experts in bacteriology as related to the home. The department offers undergraduate work carefully selected to provide sound preparation for work at the Ph.D. level.

Undergraduate majors in this department usually have included the following basic courses in their programs: 304A, 501, 534, 535, 536, 575, and Seminar. As supporting work, undergraduate majors have found the following courses desirable: Chem. 101, 102, 103, 215, 321, 322, 323, 331, 332, 333; Phys. 211, 212, 213; Math. 211, 212, 213. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counselors who wish to estimate the amount of basic, non-specialized study which may be needed.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in physiological, systematic, soil, dairy, veterinary, sanitary, food, and household bacteriology; and minor work to students taking major work in other departments.

Specific prerequisite to major graduate work in bacteriology is the completion of at least one thorough course each in general bacteriology, chemistry (including inorganic and organic), and physics. Physiological and biophysical chemistry are advised. Students taking major work in soil bacteriology should have completed courses in soils substantially equivalent to those required of undergraduates in the curriculum in agronomy at this institution. Students taking major work in dairy bacteriology should have completed courses in dairy industry substantially equivalent to those required of undergraduate students in dairy industry at this institution. Students taking major work in physiological bacteriology should have completed courses in biochemistry, physics, and at least one year of organic chemistry. A minor in chemistry is required.

Minor work is recommended in physiological, physical, biophysical, organic, and sanitary chemistry; biochemistry; mathematics, and physics.

Open to graduate students for minor only: 350, 450.

Description of Courses

Courses Primarily for Undergraduate Students

200. General Bacteriology. (3-0-0) Cr. 3. F.W.S.
Prerequisite: Chem. 101.
Non-technical discussion of the role of bacteria in everyday life; health, industry, agriculture, the home; sanitation; war. Not intended for students taking 304.

224. General and Pathogenic Bacteriology. (Vet.Hyg. 224) See Veterinary Hygiene.

225. Pathogenic Bacteriology. (Vet. Hyg. 225) See Veterinary Hygiene.

304. General Bacteriology I. F.W.S.
Prerequisite: Organic Chemistry. (Exception 304D. *Prerequisite:* General Chemistry).
A. Students in agronomy, dairy industry and science. (3-0-6) Cr. 5. F.W.S.
B. Students in home economics. (3-0-6) Cr. 5. F.W.S.
C. Students in chemical engineering. (3-0-3) Cr. 4. S.
D. Students in civil engineering. (2-0-3) Cr. 3. F.W.
E. Students in animal husbandry, forestry, horticulture, poultry husbandry and agricultural journalism. (3-0-6) Cr. 5. F.W.S.
Morphology, classification, physiology, and cultivation of bacteria; relation of bacteria to health of man, animals, and plants; the home, sanitation and industry.

350. Dairy Bacteriology. (D.I. 350) See Dairy Industry.

404. Special Problems. Cr. 1 to 5. Permission of head of department. F.W.S.

450. Special Dairy Bacteriology. (D.I. 450) See Dairy Industry.

Courses for Advanced Undergraduate and Graduate Students

501. General Bacteriology II. (3-0-6) Cr. 5. F.
Prerequisite: 304A or B. Mr. Shapiro
Intermediate morphology, cytology, and physiology of microorganisms.

531. Physiology of Viruses. (3-0-6) Cr. 3 or 5. Alt. F. Offered 1952
Prerequisite: 304A or B, Chem. 333 Mr. Schlenk
History, nature, classification and taxonomy, physiology and metabolism of viruses.

534. Sanitary Bacteriology. (2-0-6) Cr. 4. F.
Prerequisite: 304. Mr. Fowler
Microorganisms in water supplies; bacteriology of sewage; disinfection and disinfectants.

535. Food Bacteriology. (2-0-6) Cr. 4. W.
Prerequisite: 304A or B. Mr. Ayres
Bacteria, yeasts and molds in food products; food industries; food processing and its bacteriological control.

536. Laboratory Methods and Diagnosis. (2 0-6) Cr. 4. S.
Prerequisite: 304A or B. Mr. Quinn

537. Municipal and Rural Sanitation. (3-0 0) Cr. 3. S.
Prerequisite: 304. Mr. Fowler
Principles of water supply, sewage and garbage disposal, disinfection, control of contagious diseases.

546, 547. Food Technology. (Chem. 546, 547) (2-0-0) Cr. 2 each. Alt. W.S. Not offered 1953
Prerequisite: 304. Permission of instructor. Messrs. Ayres, Tischer
Technical problems of the food industry. Lectures and seminars by specialists in various fields related to food processing and marketing.

558. Milk Inspection. (D.I. 558) See Dairy Industry.

559. Bacteriology of Butter and Cheese. (D.I. 559) See Dairy Industry.

560. Systematic Bacteriology. (3 0 0 or 4) Cr. 3 or 5. Alt. F. Offered 1952
Prerequisite: 304. Mr. Werkman
History of bacterial classification. International rules of nomenclature as applied to bacteria, development of classification of bacteria based upon relationships. Critical survey of characteristics of bacterial groups.

561, 562, 563. Seminar. Cr. 1 each. Yr.
Required of all students taking major work in bacteriology. Mr. Werkman

567, 568, 569. Introduction to Biophysics. (Phys. 567, 568, 569) (Gen. 567, 568, 569) See Physics.

571, 572, 573. Seminar in Physiological Bacteriology and Fermentations. Cr. 1 each. Yr.
For majors in physiological bacteriology. Messrs. Schlenk, Werkman

575. Immunity and Serum Therapy. (3-0-3) Cr. 4. W.
Prerequisite: 304A or B. Mr. Quinn
Theories of immunity and immunization, preparation of vaccines and antisera.

585. Soil Bacteriology. (Agron.. 585) See Agronomy.

596. Special Topics. Cr. 2 to 4. F.W.S.
A. Soil Bacteriology. (Agron. 596.) Mr. Bartholomew
Prerequisite: Permission of instructor.
B. General Bacteriology. Mr. Werkman
Prerequisite: Permission of instructor.

Courses for Graduate Students

681, 682, 683. Physiology of Bacteria. (3-0-0 or 6) Cr. 3 or 5. Yr.
Mr. Werkman
(681) Influence of chemical and physical environment on bacteria, bacterial nutrition. (682) Bacterial metabolism, functions of intermediary catalysts. (683) Industrial fermentations.

684. Physiology of Bacteria. (3-0-0) Cr. 3. Offered on request.
Prerequisite: Permission of the head of the department. Selected topics in the field of physiological and chemical bacteriology.

655. Conference in Dairy Bacteriology. (D.I. 655) See Dairy Industry.

656. Identification of the Organisms Common in Dairy Products. (D.I. 656) See Dairy Industry.

685. Advanced Soil Bacteriology. (Agron. 685) See Agronomy.

690. Research.
A. Soil Bacteriology. (Agron. 690A.) Messrs. Bartholomew, Clark
B. Pathogenic Bacteriology. (Vet. Hyg. 690B.) Messrs. Biester, Merchant, Schwarte
C. Dairy Bacteriology. (D.I. 690C) Messrs Baker, Nelson
D. General or Systematic Bacteriology. Mr. Werkman
E. Pathogenic Bacteriology, and Immunology. Messrs. Merchant, Werkman
F. Food Bacteriology. Mr. Ayres
G. Physiology of Bacteria and Fermentations. Messrs. Schlenk, Werkman
H. Household Bacteriology. Messrs. Ayres, Werkman
I. Sanitary Bacteriology. Mr. Werkman

695. Seminar. (Agron. 695) See Agronomy.

Botany

WENDELL HUGHELL BRAGONIER, Ph.D., Head of Department

Professors: John M. Aikman, Ph.D.; Arthur Lawrence Bakke, Ph.D.; Joseph Charles Gilman, Ph.D.; Walter Earl Loomis, Ph.D.; John Nathan Marfin, Ph.D.; Irving E. Melhus, Ph.D.; H. C. Murphy, Ph.D.; Charles Steven Reddy, Ph.D.; John Eugene Sass, Ph D ; Erhardt P Sylwester, Ph.D.; Edgar F. Vestal, Ph.D.

Associate Professors: Samuel Aronoff, Ph.D.; Walter F. Buchholtz, Ph.D.; Sherret S. Chase, Ph.D.; Duane Isely, Ph.D.; Richard W. Pohl, Ph.D.; George Semeniuk, Ph D.; Frederick G. Smith, Ph.D

Assistant Professors: Louis Nelson Bass, Ph D.; James Monroe Crall, Ph.D.; John D. Dodd, Ph.D.; Leroy Everett Everson, Ph.D.; William J. Hooker, Ph.D.; Frode E. Lind, Ph.D.; Arden Frederick Sherf, Ph.D.; David William Staniforth, Ph.D.; Samuel Wiggans, Ph.D.

Instructors: Anderson, Haskett, Hoffman, Holt, Moyer, Seaman, Smith, Tiffany, West, Young

Opportunities for Undergraduate Study

For undergraduate curriculum in science, major in botany, leading to the degree of Bachelor of Science, see page 144

The department offers preparation for work in plant sciences. Students interested in professional scientific positions as teachers, research or extension workers in colleges, experiment stations, or government bureaus may prepare for graduate study in botany, plant pathology, genetics, or agriculture. Students interested in field work and action programs with government agencies or industrial concerns should major in botanical technology. Graduates may obtain positions with seedsmen, nurseries, canners, plantations, the conservation services, etc., as seed

technologists, disease control specialists, conservationists, plantation managers, or as buyers and salesmen, particularly in the seed fungicide trades.

Undergraduate majors in this department usually have included the following basic courses in their programs: 102, 103, 204, 205, 206, 207, 424, 504, 506, 555, 556, 599. As supporting work, undergraduate majors have found the following courses desirable: Bact. 304A; Chem. 101, 102, 103, 211, 334, 335; Ec. 261, 262; Gen. 300; Geol. 200; Math. 101, 102, 103 or 101, 112, 113; Phys. 211, 212, 213; Stat. 401; Zool. 104, 105. Courses in agronomy, horticulture, forestry, mathematics, geology, zoology and entomology are optional. These lists of courses are not to be regarded as statements of fixed requirements or as a complete outline of the work necessary for the major. They are given here solely for the convenience of students or counselors who wish to estimate the amount of basic, non-specialized study which may be needed.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in plant ecology, morphology, mycology, pathology, physiology, and systematic and economic botany; and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of thirty undergraduate credit hours in botany, together with supporting work in basic and applied science. Undergraduate courses in bacteriology, zoology, farm crops, or horticulture may be substituted in part for botany upon recommendation of the head of the department. Students desiring to take major work in plant physiology should present undergraduate credits in mathematics and organic or physical chemistry; courses in calculus and physics are desirable. Students wishing to major in plant pathology should present undergraduate credits in bacteriology and organic chemistry; courses in horticulture or farm crops are desirable. Students desiring to do major work in systematic botany should have prerequisites in general morphology.

Students majoring in botany will usually select minors from bacteriology, chemistry, farm crops, forestry, genetics, geology, horticulture, physics, soils or zoology and entomology.

Open to graduate students for minor only: 404, 416, 424, 438.

Description of Courses

Courses Primarily for Undergraduate Students

101. General Botany. (0-0-6) Cr. 3. F.W.S.
Introduction to the science of botany. Food production; structure, growth and reproduction of plants.
A. For students in agriculture, except farm operation
B. For students in farm operation.
C. For students in science, engineering and home economics

102*. The Plant Kingdom (0 0-6) Cr. 3. W.
Prerequisite: 101.
Nature, reproduction and possible relationships of the algae, fungi, mosses, liverworts, ferns, horsetails, club mosses, gymnosperms and angiosperms.

103. Local Flora. (0-0-6) Cr. 3. S.
Winter and spring identification of trees; identification of spring flowers and some common non-flowering plants; use of plant keys.

204. Elementary Plant Morphology. (0-0 6) Cr. 3. S.
Prerequisite: 101.
Structure of vegetative and reproductive organs of vascular plants; external form, positional relationships and anatomy of organs.

205. Elementary Plant Physiology. (0-2-4) Cr. 4. F.S.
Prerequisite: 101, Chem. 101.
Principles of absorption, conduction, transpiration, photosynthesis, respiration, growth, and reproduction.

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*Advanced undergraduates who need 102 in spring quarter to complete their programs may substitute 204 or 404 by arrangement.

206. **Systematic Botany.** (2-0 6) Cr. 4 S.
Prerequisite: 101.
Principles of classification of seed plants; survey of major plant families; identification and field study of local plants.

207. **Principles of Plant Pathology.** (2-0-6) Cr. 4. W.S.
Prerequisite: 101.
Principles underlying the nature and control of plant diseases.

216. **Weed Identification.** (0-2-6) Cr. 4. F.
Prerequisite: 101.
Identification of weeds and other economic plants in seed, seedling and mature stages. Outline of plant classification to aid in identification of unknown weeds.

255. **Field Botany.** (0-0-6) Cr. 3. S.
For students in home economics.
Not open to students with credit in 101.
Materials, methods, aesthetic and economic aspects of plant life; for public school teaching. Identification of plants; growth and reproduction.

256. **Dendrology.** (0-1-6) Cr. 4. F.
Prerequisite: 206.
Families, genera, and species of North American trees, Angiosperms.

257. **Dendrology.** (0-1-4) Cr. 3. W.
Prerequisite: 206.
Families, genera, and species of North American trees, Gymnosperms.

338. **Seed Analysis.** (Agron. 338) (0-1-4) Cr. 3. S.
Prerequisite: 216, Agron. 111.
Techniques of seed analysis used in official and commercial testings. Principles of determining seed purity and viability.

404. **Cryptogamic Botany.** (0-0 6) Cr. 3 Alt. S. Not offered 1953
Prerequisite: 101.
Structural and functional relationships of the algae, mosses, liverworts and lower vascular plants.

416. **Forest Pathology.** (0-2-6) Cr. 4. W.
Prerequisite: 205.
Life histories, influence of environmental conditions, pathogenicity, and control measures of forest disease pathogens and microorganisms attacking lumber.

418. **Principles of Weed Control.** (0 3-0) Cr. 3. Alt. W. Offered 1953
Prerequisite: 205.
Ecology and physiology of weeds as related to their control. Factors affecting prevalence and survival of weeds; use of chemicals and other means of eradicating annual and perennial weeds.

424. **General Plant Ecology.** (0-2-3 or 6) Cr. 3 or 4. F.S.
Prerequisite: 205.
Native and crop vegetation in relation to factors of environment; application to forestry, grazing, and general plant production.

438. **Seed Viability.** (Agron. 438) (0-1-4) Cr. 3. Alt. W. Not offered 1953
Prerequisite: 205.
Principles and methods of seed germination; factors affecting viability and dormancy; physiology of germination.

456. **Poisonous Plants.** (2-0-4) Cr. 3. F.
Prequisite: 101, V Phys. 164, or permission of instructor.
Classification, distribution, identification, and control of poisonous plants; principal types of plant poisons and their effects on animals.

474. **Special Problems.** Cr. 2 to 5. F.W.S.
Prerequisite: 15 credits in botany.
A. Morphology.
B. Physiology.
C. Plant Pathology.
D. Mycology.
E. Systematic Botany.
F. Plant Ecology.
G. Economic Botany.

Courses for Advanced Undergraduate and Graduate Students

504. **Plant Cytology.** (2-0-4) Cr. 3. F.
Prerequisite: 205, 102 or 404. Messrs. Chase, Sass
Cell structure. Cytoplasm and its inclusions. Nucleus and its relation to genetic problems.

506. **Principles of Mycology.** (0-2-3) Cr. 3. F.
Prerequisite: 207 or Bact. 304A. Mr. Gilman
Morphology, cytology and physiology of fungi; their relation to agriculture and industry.

507. **Phytopathology.** (0 2-3) Cr. 3. W.
Prerequisite: 205, or permission of instructor. Mr. Semeniuk
Fundamentals of parasitism and disease control.

511, 512, 513. **Plant Physiology.** (0-3-0 or 6) Cr. 3 or 5 each. F.W.S.
Prerequisite: 205, Chem. 256. Mr. Loomis
Water relations of plants, mineral and organic nutrition, physiology of growth and reproduction.

517. **Physiological Methods and Technique.** (0-1-6) Cr. 3. W.
Prerequisite: Permission of instructor. Mr. Aronoff

534. **Industrial Mycology.** (2-0-0 to 6) Cr. 2 to 4. Alt. S. Not offered 1953
Prerequisite: 207, Bact. 304 or equivalent. Mr. Gilman
Relation of fungi to human affairs; harmful and helpful activities of fungi. In dustrial utilization of fungi.

535. **Disease Control.** (0-2-3) Cr. 3. S.
Prerequisite: 507 or 571. Mr. Buchholtz
Exclusion, eradication, protection, and methods of selection for disease resistance Preparation of fungicides and theories of fungicidal action.

536. **Plant Pathological Technique.** (0-2-6) Cr. 4. W.
Prerequisite: 207. Mr. Hooker
Cultural, physiological, and histological techniques. Laboratory practice in isolation of parasites, germination, inoculation, and carrying stock cultures.

538. **Seed Borne Pathogens.** (Agron. 538) (0-1-4) Cr. 3. Alt. S. Offered 1953
Prerequisite: 207. Mr. Semeniuk
Detection, identification, and control of parasitic organisms carried by crop seeds

554. **Morphology of Crop Plants.** (0-0-6) Cr. 3. S.
Prerequisite: 205. Mr. Martin
Structure and structural development of more important crop plants as related to their cultivation.

555. **Botanical Microtechniques.** (1-0 6) Cr. 3. F.
Prerequisite: 205. Mr. Sass
Methods of killing, imbedding, sectioning, and staining plant material. Methods of studying and recording microscopic preparations; microscopy, micrometry, projection.

556. **General Histology.** (2 0 4) Cr. 4. W.
Prerequisite: 205. Mr. Sass
Origin, development and cellular structure of tissues of vegetative organs of seed plants.

559. **Advanced Morphology.** (0-2-3) Cr. 3. S.
Prerequisite: 556. Mr. Sass
Comparative morphology and histology of vegetative and reproductive organs of selected groups of plants.

565. **Advanced Field Botany.** (0 2 12) Cr. 3. Alt. SS. Offered 1952
Prerequisite: 206. Mr. Pohl
Field study, collection, preservation and identification of local flora.

†566. **Native Range Plants.** (0-1-6) Cr. 3. F.
Prerequisite: 206. Mr. Pohl
Not open to students with credit in 595
Geographic distribution, identification, and use of native field and forest forage plants.

571, 572, 573. **Advanced Plant Pathology.** (0-2-3) Cr. 3 each Yr.
Prerequisite: 207. Mr. Buchholtz
Diseases of field and horticultural crops caused by phycomycetes and ascomycetes; bacteria and viruses; smut and rust fungi, respectively.

575. **Field Mycology.** (0-2-12) Cr. 3. SS.
Prerequisite: 207. Mr. Gilman
Collection and taxonomy of fungi and relation of their occurrence to environmental factors. Preparation and utilization of mycological exsiccati.

576. **Field Plant Pathology.** (0 4-12) Cr. 4. Alt. SS. Offered 1952
Prerequisite: 207. Mr. Buchholtz
Technique and interpretation of field plots; methods of preparation and application of fungicides; surveys and estimates of crop losses.

579. **Special Topics.** Cr. 2 to 5. F.W.S.
Prerequisite: 15 credits in botany and permission of instructor.
A. Morphology. Messrs. Chase, Martin, Sass
B. Physiology. Messrs. Aronoff, Bakke, Loomis, Smith
C. Plant Pathology. Messrs. Bragonier, Buchholtz, Gilman, Hooker, Melhus, Murphy, Reddy, Semeniuk
D. Mycology. Mr. Gilman
E. Systematic Botany. Mr. Pohl
F. Plant Ecology. Mr. Aikman
G. Economic Botany. Messrs. Bragonier, Isley, Melhus

584. Advanced Plant Ecology. (0-2-8) Cr. 8. F.
Prerequisite: 424. Mr. Aikman
Origin, development, and reactions of vegetation; classification of vegetation units; plant indicators.

585. Experimental Field Ecology. (0-1-6) Cr. 3. F.W.S.
Prerequisite: 424. Mr. Aikman
Quantitative investigation of environment; methods and instruments used; problems.

590. Advanced Systematic Botany. (2-0-6) Cr. 3. S.
Prerequisite: 206. Mr. Pohl
Principles of plant classification; bibliographic tools of systematic botany; methods of collection, preservation and study of vascular plants.

595. Agrostology. (0-1-6) Cr. 3. F.
Prerequisite: 206.
Morphology, classification and identification of grasses; utilization of grasses in agriculture and grazing. Not open to students with credit in 566

599. History of Botany. (3-0-0) Cr. 3. Alt. S. Offered 1953
Prerequisite: 15 credits in botany. Mr. Gilman

Courses for Graduate Students

605. Cytogenetics. (Gen. 605) (2-0-4) Cr. 3. W.
Prerequisite: 504 and Gen. 800. Mr. Chase
Chromosome association and segregation, and the bearing of chromosome behavior on inheritance and evolution.

606. Morphology of Algae. (0-0-6) Cr. 3. Alt. S. Not offered 1953
Prerequisite: Permission of instructor. Mr. Dodd
Structure, reproduction, and systematic position of algae.

613. Advanced Plant Physiology. (3-0-0 to 6) Cr. 3 to 5. S.
Prerequisite: Permission of instructor. Mr. Aronoff
Biophysical and biochemical processes underlying plant physiology. Structure of protoplasm; mechanisms of energy transfer; relations between molecular structure and biological activity.

618. Enzymes in Plant Metabolism. (3-0-0 to 6) Cr. 3 to 5. S.
Prerequisite: Permission of instructor. Mr. Smith
Nature of enzyme action, their role in metabolism, and methods of investigation.

624. Physiology of Fungi. (3-0-0 to 6) Cr. 3 to 5. W.
Prerequisite: 506 or permission of instructor. Mr. Smith
Special physiology of fungi; nutrition, metabolism, growth and toxicology.

641, 642, 643. General Mycology. (0-2-6) Cr. 4 each. Yr.
Prerequisite: 207. Mr. Gilman
Taxonomy, morphology and phylogeny of slime molds and fungi (phycomycetes, ascomycetes, fungi imperfecti, and basidiomycetes).

654. Advanced Plant Ecology. (0-2-8) Cr. 8. S.
Prerequisite: 584. Mr. Aikman
Relation of environmental conditions to growth and competition in plants.

695. Research.
A. Morphology. Messrs. Chase, Martin, Sass
B. Physiology. Messrs. Aronoff, Bakke, Loomis, Smith
C. Plant Pathology. Messrs. Bragonier, Buchholtz, Gilman, Hooker, Melhus, Murphy, Reddy, Semeniuk
D. Mycology. Mr. Gilman
E. Systematic Botany. Mr. Pohl
F. Plant Ecology. Mr. Aikman
G. Economic Botany. Messrs. Bragonier, Isely, Melhus

698. Seminar. F.W.S.
Meetings of botanical staff and students to discuss recent literature, and problems under investigation.
A. For students taking major work in morphology and taxonomy.
Cr. 1. Messrs. Chase, Martin, Pohl, Sass
B. For students taking major work in physiology and ecology.
Cr. 1. Messrs. Aikman, Aronoff, Bakke, Loomis, Smith
C. For students taking major work in plant pathology.
Cr. 1. Messrs. Bragonier, Buchholtz, Gilman, Hooker, Melhus, Murphy, Reddy, Semeniuk
D. For staff and students in botany. Required.

Ceramic Engineering

CHARLES M. DODD, Cer.E., Head of Department

Assistant Professor: Elmer Scott Fitzsimmons, Sc.D.

Instructor: Bauleke

Opportunities for Undergraduate Study

For undergraduate curriculum in ceramic engineering leading to the degree of Bachelor of Science, see page 118.

Ceramic engineering deals with those products formed from earthy minerals which are rendered durable by a process of heat treatment at high temperatures. This includes most of the non-metallic inorganic substances manufactured into such commodities as structural clay products; fire brick and refractories; white wares, including dinnerware, chemical and electrical porcelain, floor and wall tile; glass; porcelain enamels on metals; art pottery; cements, limes and plasters; abrasives, and many other similar products.

The ceramic engineer is concerned with the technical problems encountered in the development, control, production and use of these products. He must also be well versed in the methods employed for winning, forming, drying and firing of ceramic raw materials. The ceramic engineer receives a well-rounded education to fit him for research, production, equipment and plant design or sales engineering, depending upon the capabilities and inclination of the individual.

Opportunities for Graduate Study

The department offers major work leading to the degrees of Master of Science and Doctor of Philosophy in ceramics and ceramic engineering, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of a curriculum in ceramic engineering, ceramic technology, engineering or physical science equivalent to that required of undergraduate students at this institution.

Minor work will be selected in related fields.

Open to graduate students for minor only: 315, 316, 404, 406.

Description of Courses

Courses Primarily for Undergraduate Students

100. Orientation. (1-0-0) **Required.** S.

201, 202, 203. Seminar. (1-0-0) Required. Yr.

206. Winning and Forming of Ceramic Raw Materials. (4-0-0) Cr. 4. F.
Brief ceramic history; prospecting for and winning ceramic raw materials; methods of forming raw materials into ware for drying.

207. Ceramic Raw Materials. (4-0-0) Cr. 4. W.
Prerequisite: Chem. 103.
Geological formation; geographical distribution and occurrence, behavior and chemical and physical properties of the more important ceramic raw materials.

208. Drying and Firing of Ceramic Wares. (4-0-0) Cr. 4. S.
Prerequisite: 206, 207.
Theory; physical and chemical changes resulting from drying and firing of formed ware, combustion of fuels, pyrometry, available equipment.

301, 302, 303. Seminar. (1-0-0) Required. Yr.

309. Physical and Chemical Properties of Ceramic Materials. (0-3-9) Cr. 6. F.
Prerequisite: 208.
Calculations; determinations with clays and other ceramic materials in the raw, plastic, dry and fired state.

315. Ceramic Bodies, Glazes and Colors. (3-0-0) Cr. 3. W.
Prerequisite: 309 or permission of instructor.
Essentials of a ceramic body; properties and processing of types of ceramic wares; clay ware decoration; glazes and correction of their defects; colors, their composition and process of manufacture.

316. Enamels. (0-3-3) Cr. 4. S.
Prerequisite: 309 or permission of instructor.
Sheet metal, cast iron, and jewelry enamels; their composition, processing, and finished products; tests and specifications. Laboratory in enameling practice.

400. Inspection Trip. Required. F.
Prerequisite: Senior Cer.E. classification.
One week trip inspecting ceramic plants and studying industrial methods of production.

401, 402, 403. Seminar. (1-0-0) Required. Yr.

404. Refractories. (0-3-0) Cr. 3. S.
Prerequisite: 309 or permission of instructor.
Manufacture, properties, uses, performance, and testing of basic, neutral, and acid refractories.

406. Glass Technology. (0-3-0) Cr. 3. F.
Prerequisite: 309 or permission of instructor
Industrial and artistic glass. Composition, raw materials, control, specifications; manufacturing processes; finished products and their properties; plant layout; machinery and equipment.

411, 412. Ceramic Products Development and Control.
411. (1-0-9) Cr. 4. W. 412 (1-0-6) Cr. 3. W.S.
411. *Prerequisite:* 315.
412. *Prerequisite:* 411.
Laboratory practice with brick, tile, white wares, fine special ceramic wares and decorating materials; testing of finished products.

424, 425. Ceramic Engineering Design.
424. *Prerequisite:* C.E. 331. (2-0-9) Cr. 5. F.
Calculations for ceramic plant structures of timber, masonry, reinforced concrete and steel; production of working drawings and plans from design data.
425. *Prerequisite:* 424 (2-0-6) Cr. 4. W.
Design for a ceramic drier, kiln and a ceramic plant.

431, 432, 433. Ceramic Engineering Applications. (0-0-9) Cr. 3 each. Yr.
Prerequisite: Senior classification.
Investigation of an approved problem. Introduction to research methods. Literature review, laboratory determinations, and writing of a report.

Courses Primarily for Advanced Undergraduate and Graduate Students

511, 512, 513. Advanced Ceramic Technology. (2-0-0) Cr. 2 each.
Prerequisite: Permission of instructor. Mr. Dodd
Fundamentals of ceramic processes, raw materials, and fabrication, including refractories, glass, bodies and glazes, enamels. Offered on request.

514, 515, 516. Ceramic Technology Laboratory. (0-0-9) Cr. 3 each.
Prerequisite: Concurrent with 511, 512, 513 Mr. Dodd
Laboratory practice in determining plasticity, shrinkage, viscosity, differential thermal analysis, glaze fit, expansion, particle size measurement.

532, 533. Physico-Colloidal Properties of Clay Minerals. (2-0-0) Cr. 2 each.
Prerequisite: Permission of instructor. Mr. Dodd
Fundamentals of physico-colloidal phenomena as applied to clay minerals. Offered on request.

535, 536. Physico-Colloidal Laboratory. (0-0-6) Cr. 2 each.
Prerequisite: Concurrent with 532, 533. Mr. Dodd

550. Special Topics. (To be arranged.)
Prerequisite: Permission of instructor. Mr. Dodd

Courses for Graduate Students

611, 612, 613. Theoretical Ceramics. (3-0-0) Cr. 3 each. Yr.
Prerequisite: Permission of instructor. Mr. Dodd
Theory of technology of ceramic materials and application to industrial methods. Methods of determining physical properties of ceramic materials and finished products.

614, 615, 616. Ceramic Laboratory. (0-0-9) Cr. 3 each.
Prerequisite: Concurrent with 611, 612, 613. Mr. Dodd
Physical properties of ceramic materials.

620. Seminar. (1-0-0) Cr. 1. Mr. Dodd

621, 622, 623. **Advanced Ceramic Engineering Design.** (2-0-6) Cr. 4 each.
Prerequisite: 425. Mr. Dodd
Specialized ceramic machinery, driers, kilns and plant structures.

632, 633. **Advanced Physico-Colloidal Properties of Ceramic Materials.** (3-0-0) Cr. 3 each. Yr.
Prerequisite: Chem. 484 or equivalent. Mr. Dodd
Fundamentals of physico-colloidal phonomena as applied to ceramics, including theories of deflocculation, rheological properties, including plasticity and anomalies; ion exchange and electro-dialysis, micromeritics.

635, 636. **Advanced Physico-Colloidal Laboratory.** (0 0-6) Cr. 2 each.
Prerequisite: Concurrent with 632, 633. Mr. Dodd

690. **Research.** Mr. Dodd

Chemical and Mining Engineering

GROVER LEON BRIDGER, Ph.D., Head of Department

Professors: Lionel K. Arnold, Ph.D.; Burrell Franklin Ruth, Ph.D.; Orland Russell Sweeney, Ph.D.; Henry Albert Webber, Ph.D.

Assistant Professors: Gerhard H. Beyer, Ph.D.; Charles Olin Frush, B.S ; William R. Millard, Ph.D.; Morton Smutz, Ph.D.

Instructors: Boylan, May, Walker

Opportunities for Undergraduate Study

For undergraduate curricula in chemical engineering and in mining engineering leading to the degree of Bachelor of Science, see pages 119 and 126.

The department was established to supply men for those industries which require engineers with a thorough knowledge of chemistry. Since raw materials are being elaborated into such a large variety of materials by means of chemical processes, there is a large and constantly increasing demand for men trained in the fundamental operations of chemical engineering. To list only a few of the demands for these men, there is cited the manufacture of heavy chemicals, dyes, sugar, foods, soap, electro-chemical products, paints, varnishes, lacquers, gas, tar, coke, and coal tar products. In the mining fields such materials as coal, clay, gypsum, and metal ores demand their quota of trained engineers.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science in chemical engineering and mining engineering, and Doctor of Philosophy in chemical engineering; and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of an undergraduate curriculum substantially equivalent to that offered in chemical engineering at this institution.

Minor work will usually be selected from chemistry, mechanical engineering, civil engineering, electrical engineering, ceramic engineering, general engineering, mathematics, mineralogy, physics, economics, geology, or bacteriology.

Open to graduate students for minor only:

Chemical Engineering. 303, 361, 362, 363, 411, 412, 413, 421, 422, 423, 441, 442, 443, 461, 471, 472, 473.

Mining Engineering. 301, 302, 303, 314, 321, 322, 323, 417, 431, 432, 433.

Description of Courses

Courses in Chemical Engineering

Courses Primarily for Undergraduate Students

100. Technical Lecture. (1-0-0) Required. S.
Introduction to fields of chemical and mining engineering; relation of chemical and mining engineering to industry.

161, 162, 163. Chemical Engineering Laboratory. (0-0-3) Cr. 1 each. Yr.
Open only to students permanently excused from military training. An approved assignment as laboratorian on special problems.

200. Introduction to Chemical Engineering. (3-0-0) Cr. 3. F.
Introductory calculations and concepts.

303. Industrial Stoichiometry. (3-0-0) Cr. 3. S.
Prerequisite: 200, Chem. 216.
Chemical engineering units and systems of measurement; energy and material balances; fuels and combustion.

361, 362, 363. Chemical Engineering Unit Operations. (3-0-0) Cr. 3 each. Yr.
Introduction to chemical engineering theory and equipment, with emphasis on problem applications.

361. *Prerequisite:* 303.
Crushing and grinding, screening and size separation, conveying, mixing, crystallization, filtration, and extraction.

362. *Prerequisite:* 303.
Fluid flow, heat transfer, and evaporation.

363. *Prerequisite:* 362.
Diffusional operations; drying, humidification and air conditioning, distillation, and absorption.

400. Senior Inspection Trip. Required. F.
Prerequisite: Senior Chem. E. classification.
Visits to chemical industries and plants in an industrial area for one week.

401, 402, 403. Technical Seminar. (0-1-0) Required. Yr.
To accompany 411, 412 and 413.
Technical reports and discussions of current chemical engineering literature.

411, 412, 413. Chemical Process Industries. (3-0-0) Cr. 3 each. Yr.
Prerequisite: Credit or classification in Chem. 332.
Detailed studies of the history, raw materials, manufacturing methods, economics and chemistry of industrial chemical processes; coordination of unit operations and processes employed.

421, 422, 423. Chemical Engineering Laboratory. (0-0-9) Cr. 3 each. Yr.
Prerequisite: C. E. 484 and credit or classification in 361 and 363.
Laboratory application of the theory studied in 361, 362, and 363 to the testing and use of unit operation and process equipment; computation of experimental data; application of results to process design; writing of reports.

441, 442, 443. Elements of Chemical Engineering. (1-1-3) Cr. 3 each. Yr.
Prerequisite: Chem. 333.
Industrial stoichiometry, raw materials, fundamental chemical engineering operations, chemical engineering equipment and chemical process industries. For non-chemical engineering students desiring a knowledge of chemical engineering fundamentals.

461. Chemical Engineering Thermodynamics. (3-0-0) Cr. 3. F.
Prerequisite: 363, credit or classification in Chem. 323.
Applications to unit operations and processes.

465, 466. Special Problems. 465 (0-0-3 to 9) Cr. 1 to 3; 466 (0-0-3 to 9) Cr. 1 to 3. Yr.
Introduction to research methods; investigation of an approved topic.

471, 472, 473. Chemical Engineering Design. 471, 472 (1-0-6) Cr. 3 each; 473 (0-0-6) Cr. 2. Yr.
Prerequisite: 362, T&A.M. 324.
Design and layout of chemical plants and equipment; principles of process development.

Courses for Advanced Undergraduate and Graduate Students

504. Plastics Technology. (3 0-0 or 3) Cr. 3 or 4 S.
Prerequisite: Chem. 333. Mr. Arnold
Chemistry and technology of plastic resins; production and use of finished plastic products.

531, 532, 533. Chemical Engineering in the Food Industries. (3-0-3) Cr. 4 each.
Alt. Yr. Not offered 1952-53. Mr. Webber
Applications of chemical engineering principles in the food industries.
For food technology students.

561. **Advanced Chemical Engineering Thermodynamics.** (3-0-0) Cr. 3. W.
Prerequisite: 461. Mr. Beyer
Applications to unit operations and processes.

564. **Humidification, Water Cooling, and Drying.** (0 3 0) Cr. 3. S.
Prerequisite: 363. Mr. Ruth
Drying and water cooling; problem solutions.

565. **Distillation.** (0-3-0) Cr. 3. W.
Prerequisite: 363. Mr. Webber
Simple and compound rectifying columns, azeotropic, extractive, and steam distillation; problem solutions.

566. **Absorption and Extraction.** (0-3-0) Cr. 3. F.
Prerequisite: 363. Mr. Arnold
Gas absorption and solvent extraction; problem solutions

574. **Advanced Plant Design.** (0-0-6) Cr. 2. F.
Prerequisite: 478 or permission of instructor. Mr. Bridger
Design of a complete chemical plant.

584. **Applied Electro-Chemistry.** (3-0-0) Cr. 3. S.
Prerequisite: 411. Mr. Webber
Primary cells and storage batteries; electrolytic processes of chemical manufacture; electro-refining and electro-winning; electric furnaces and electric furnace products.

585. **Chemical Engineering Kinetics.** (3-0-0) Cr. 3. S.
Prerequisite: 561 or permission of instructor. Mr. Beyer
Theory of absolute reaction rates; mass and heat transfer in catalytic beds; treatment of differential and integral conversion data.

599. **Special Topics.** Cr. 2 to 5 each time elected. F.W.S.
Messrs. Arnold, Beyer, Bridger, Ruth, Sweeney, Webber

Courses for Graduate Students

600. **Chemical Engineering Research.**
Messrs. Arnold, Bridger, Ruth, Sweeney, Webber

601, 602, 603. **Seminar.** (1-0-0) Cr. 1 each. Yr.
Messrs. Arnold, Bridger, Ruth, Sweeney, Webber

610. **Chemical Engineering Investigations.** (2 1-0) Cr. 3. F.
Prerequisite: 413. Mr. Sweeney
Research methods, current problems.

614. **Heavy Inorganic Chemical and Fertilizer Industries.** (3-0-0) Cr. 3. W.
Prerequisite: 413, or permission of instructor Mr. Bridger
Manufacture of commercial fertilizers and related heavy inorganic chemicals.

615. **Organization of Chemical Engineering Industries.** (3-0-0) Cr. 3. S.
Prerequisite: 413. Mr. Sweeney
Development of chemical engineering industry based upon fundamental principles of plant location, design, unit operation costs, power utilization management, and operation.

617. **Utilization of Agricultural By-Products.** (3-0 0) Cr. 3. F.
Prerequisite: Chem. 333. Mr. Arnold
Occurrence and chemical composition of agricultural by-products such as corn stalks, corncobs, oat hulls, and straws; their present and possible utilization in insulating board, pressed board, paper, furfural, and plastics.

618. **Oil and Fat Industries.** (3-0 0) Cr. 3. W.
Prerequisite: Chem. 333. Mr. Arnold
Occurrence and composition of vegetable and animal oil, and fat-bearing materials; methods of oil separation, refining, and bleaching; utilization in products such as foods, paints, and soaps.

651, 652, 653. **Chemical Engineering Unit Operation Theory I.** (3-0 0) Cr. 3 each.
Alt Yrs Offered 1952-53
Prerequisite: 363 and 423, or permission of instructor. Mr. Ruth
Technology of fine particles; determination of average particle size, size distribution, and surface area; flow of fluids through granular porous media; application to filtration, sedimentation, size separation, fluidization, extraction, crystallization, drying, crushing and grinding, and heat transfer to beds of granular solids.

661, 662, 663. **Chemical Engineering Unit Operation Theory II.** (3 0-0) Cr. 3 each.
Alt. Yrs Not offered 1952-53
Prerequisite: 363 and 423, or permission of instructor Mr. Ruth
Mechanics of turbulent flow and eddy diffusion; fluid friction in smooth and rough pipes; correlation of fluid friction with heat and mass transfer; various diffusional operations involving the simultaneous exchange of heat and mass in turbulent flow.

Courses in Mining Engineering

Courses Primarily for Undergraduate Students

301, 302, 303. Mining Methods. (2-0-0) Cr. 2 each. Yr.
Prerequisite: Chem. 212 or Geol. 202.
Prospecting, subsidence and support, drilling and blasting, hoisting, haulage, drainage and ventilation. Placer, open-cut, and underground mining methods. Mine examination and administration.

304 Industrial Stoichiometry. (3 0-0) Cr. 3. S.
Prerequisite: Chem. 212.
Mining engineering units and system of measurement, energy and material balances; fuels and combustion.

314. Principles of Metallurgy. (3-0-0) Cr. 3. F.S.
Prerequisite: Chem. 212 or Geol. 355.
Hydro- and pyro-metallurgy, metallurgical equipment and processes; effects of smelter requirements of mining and milling operations.

321, 322, 323. Mining Engineering Laboratory. (0 0 6) Cr. 2 each. Yr.
Prerequisite: Credit or classification in 301.
Use of explosives; blasting practice; construction, maintenance, and operation of mining equipment. Prospecting, sampling, and mine evaluation methods.

324. Mine Surveying. (2-0-6) Cr. 4. S.
Prerequisite: C. E. 325.
Precise surface and underground surveying for mapping and boundary determinations, mining claims, track and mill layouts.

361, 362. Elements of Mining Engineering. (3 0-0) Cr. 3 each. F.W.
Prerequisite: 304.
Fundamental unit operations of mining and metallurgical engineering; fluid flow, heat transfer and evaporation

400. Senior Inspection Trip. Required. F.
Prerequisite Senior Mn.E. classification.
One-week field trip to mines and mills in Iowa, South Dakota, or Missouri.

417. Fire Assaying. (1-0-6) Cr. 3. W.
Prerequisite: Chem 212 or Geol 355
Determination of gold, silver, platinum, and base metals by assay fusions and related processes.

431, 432, 433. Mineral Dressing. (2 0-6) Cr. 4 each. Yr.
Prerequisite: Chem. 212 and Geol. 355.
Theory and practice of mineral dressing; use of milling equipment; control of operations; economic aspects.

465, 466. Mining Engineering Applications. (0 0 6 to 15) Cr. 2 to 5 each. F.W.S.
Special problems on approved mining engineering topics.

471, 472, 473. Mining Engineering Design. 471, 472. (1-0-6) Cr. 3 each; 473 (0 0 6) Cr. 2. Yr.
Prerequisite: 362
Design of mine structures and installations; selection of mine plant equipment.

Course for Advanced Undergraduate and Graduate Students

599 Special Topics. Cr 2 to 5 each time elected F.W S

Course for Graduate Students

600. Research. Messrs. Bridger, Sweeney

Chemistry

CHARLES ALBERT GOETZ, Ph.D., Head of Department

Professors: Emerson W. Bird, Ph.D.; Frank Emerson Brown, Ph.D; Winfred Forrest Coover, D.Sc.; Harvey Diehl, Ph.D.; Sidney Walter Fox, Ph.D.; Ellis Ingham Fulmer, D.Sc.; Henry Gilman, Ph.D.; Ralph Malcolm Hixon, Ph.D.; Walter Bernard King, Ph.D.; Bruce Allison Rogers, Ph.D.; Robert Eugene Rundle, Ph.D.; Frank Harold Spedding, D.Sc.; Byron Henry Thomas, Ph.D.; Leland Alfred Underkofler, Ph.D.; Adolf Frank Voigt, Ph.D.; Harley A. Wilhelm, Ph.D.; John Anderson Wilkinson, Ph.D.

Associate Professors: Charles Vandiver Banks, Ph.D.; Frederick R. Duke, Ph.D.; Rachel Hartman Edgar, Ph.D.; Velmer Arthur Fassel, Ph.D.; Joseph Franklin Foster, Ph.D.; Dexter French, Ph.D.; William George Gaessler, M.S.; George Simms Hammond, Ph.D.; Robert S. Hansen, Ph.D.; Don S. Martin, Jr., Ph.D.; Nellie May Naylor, Ph.D.

Assistant Professors: Robert Scott Allen, Ph.D.; Oscar Norman Carlson, Ph.D.; Premo Chiotti, Ph.D.; Adrian H. Daane, Ph.D.; James S. Fritz, Ph.D.; Maurice Griffel, Ph.D.; David Peterson, Ph.D.; John A. Schulz, M.S.; Harrison Shull, Ph.D.; Harry J. Svec, Ph.D.; Ernest Wenkert, Ph.D.; Lester Yoder, M.S.

Instructors: Brierly, DeCoursey, DeLaHunt, Heidel, Hurst, Ingham, Miller, Peabody, Radke, Reid, Winitz

Opportunities for Undergraduate Study

For undergraduate curricula in science with a major in chemistry, chemical technology, or food technology, leading to the degree of Bachelor of Science, see page 144.

Graduates in chemistry qualify in many fields: as teachers of chemistry, as analytical or control chemists, as supervisors in industry, as technical sales personnel and as research chemists in federal, state, municipal, academic or industrial laboratories. The rapid introduction of chemical techniques in all branches of commerce and industry has caused phenomenal growth in the profession since the turn of the century. Specific mention may be made of the manufacture of glass, pigments, sugar, starch, explosives, dyes, gases, petroleum products, fine chemicals, perfumes, drugs, vitamins, hormones, solvents and the various metals and their alloys.

Undergraduate chemistry students take not only studies in chemistry but also courses in mathematics, physics, German and some in the cultural subjects. This leaves little chance for specialization within the field of chemistry, and students with the necessary high scholastic standing usually continue with graduate work where they can explore more thoroughly in the areas in which they are interested.

To meet the different needs of students of chemistry, Iowa State has two curricula, both of which lead to the Bachelor of Science degree. Both the curriculum in Chemical Technology and the curriculum in Science major in Chemistry prepare the student for graduate study and industrial work at the Bachelor of Science level. The major in chemistry allows for more credit hours in the cultural subjects while the major in Chemical Technology allows for more training in chemistry itself.

For undergraduate work in food technology, see page 232.

Undergraduate majors in this department usually have included the following basic courses in their programs: 101C, 102C, 103C, 201, 202, 215, 216, 217, 321,

322, 323, 331, 332, 333, 9 credits advanced chemistry. As supporting work, undergraduate majors have found the following courses desirable: Math. 101, 102, 103, 211, 212, 213; Phys. 211, 212, 213, 221, 222, 223. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counselors who wish to estimate the amount of basic, non-specialized study which may be needed.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in inorganic, analytical, physical, organic, micro, bio-organic, bio-physical, soil, plant, enzyme, food, dairy and sanitary, physiological and nutritional, household and textile, and agricultural chemistry; and minor work to students taking major work in other departments

In cooperation with the Institute for Atomic Research, special facilities are offered to graduate students in other departments of the College that wish to use radioactive isotopes in their research. Analytical chemistry, calculus and physics are required for this phase of chemistry.

Prerequisite to major graduate work is the completion of undergraduate work in chemistry, mathematics, and physics, substantially equivalent to that required of undergraduate students at this institution whose major is in chemical technology.

Open to graduates for minor only: 321, 322, 323, 330, 331, 332, 333, 347, 348, 403, 425, 426, 466, 474, 475, 481, 482, 483, 484

Description of Courses

Index to field of work is given by the second and third figures of course numbers:

(a) Inorganic Chemistry and Elementary Qualitative Analysis	01 to 09	(g) Household (including Textile) Chemistry	61 to 69
(b) Analytical Chemistry	11 to 19	(h) Physiological and Nutritional Chemistry	71 to 79
(c) Physical Chemistry	21 to 29	(i) Biophysical (including Enzyme and Zymo-) Chemistry	81 to 89
(d) Organic Chemistry	31 to 39	(j) Research	91 to 99
(e) Food and Sanitary Chemistry	41 to 49		
(f) Agricultural (including Plant and Soil) Chemistry	51 to 59		

Courses Primarily for Undergraduate Students

100A, 100B. Introduction to General Chemistry. (1-3-3) Cr. 2 each. F.W.S.
For students inadequately prepared for Chemistry 101. Assignment by divisional deans and Dean of the Junior College.

101, 102. General Chemistry. (1-2-4) Cr. 4 each. F.W.S.
Principles of chemistry, properties of nonmetallic and metallic elements.
C. For students desiring a more extended study F W

103. General Chemistry and Qualitative Analysis. (1-2-4) Cr. 4. F.S.
Prerequisite: 102 or permission of instructor.
Continuation of general chemistry; introduction to the reactions of individual elements and to group reactions as used in the determination of the composition of matter.
C. For students desiring a more extended study. S

105, 106 General Chemistry. (1 2-4) Cr. 4 each.
For home economic students.
(105) Principles and the nonmetallic elements. F.W
(106) Metallic elements and their compounds. W.S.

201, 202. Inorganic Chemistry. (2-0 0) Cr 2 each. 201. F.W.; 202. W.S.
Prerequisite: 103.
Principles and theories in detail

211, 212. Quantitative Analysis. (0 2 6) Cr 4 each. Yr
Prerequisite: 103.
Theory and practice of elementary gravimetric and volumetric analysis.

214. Quantitative Analysis. (0-2-6) Cr. 4. S.
Prerequisite: 211. For students in ceramic engineering.
Clay analysis.

215, 216, 217. **Quantitative Analysis.** Cr. 5 each. Variable credit allowed to those repeating course in part. Yr.
Prerequisite: 103.
215, 216. (0-3-6) Theory and practice of elementary gravimetric and volumetric analysis.
217. (0-2-9) Technical analysis of water, gas, fuels, oils and petroleum. Emphasis on the literature of analytical chemistry.

255, 256. **Applied Organic Chemistry and Quantitative Analysis.** (2 0-4) Cr. 3 each.
255. Organic Chemistry. F.W. 256. Bio-organic and Analytical Chemistry. W.S.
Prerequisite: 103.
Fundamentals with applications to agriculture. Not accepted for credit in science curricula.

257. **Applied Organic Chemistry.** (3-0-4) Cr. 4. S.
Prerequisite: 102.
For forestry students. Organic chemistry with applications. Not accepted for credit in science curricula.

259. **Chemistry of Forest Products.** (2-0-0) Cr. 2. S.
Prerequisite: 257.
Plant metabolism and plant products.

264. **Organic Chemistry.** (3-0-3 or 6) Cr. 4 or 5. F.W.S.
Prerequisite: 106.
For home economics, agricultural economics, dairy industry, rural sociology and soil science students. Fundamental principles of organic chemistry. Not accepted for credit in science curricula.

265. **Food Analysis.** (3-0-6) Cr. 5. F.W.
Prerequisite: 264.
Elementary gravimetric and volumetric analysis and methods of food analysis. Not accepted for credit in science curricula.

268. **Textile Chemistry.** (2-1-6) Cr. 5. S.
Prerequisite: 264.
Theory and practice in the chemistry of high polymers.

274. **Physiological and Nutritional Chemistry.** (2-0-3) Cr. 3. F.W.S.
Prerequisite: 264.
Fundamental principles of physiological chemistry and the chemistry of nutrition.

275. **Physiological and Nutritional Chemistry.** (3-0-6) Cr. 5. F.S.
Prerequisite: 265.
Chemical composition of living matter; metabolism; fundamentals of nutritional chemistry.

321, 322, 323. **Physical Chemistry.** (1-2-3) Cr. 3 or 4 each. Yr.
Variable credit allowed to those repeating courses in part.
Prerequisite: 215, Phys. 228, Math. 212.
Properties of gases, liquids and solids, solutions, thermochemistry and thermodynamics, chemical kinetics, electrochemistry, equilibrium, atomic and molecular structure.

330. **Laboratory in Organic Chemistry.** (0-0-6) Cr. 2. each time taken. F.W.S.
To accompany 331, 332, 333.

331, 332, 333. **Organic Chemistry.** (2-1-0) Cr. 3 each. Yr.
Prerequisite: 103; one quarter of quantitative analysis; classification in senior college or permission of instructor.
For chemistry and chemical engineering students, and students specializing in premedical and applied biological sciences.

334, 335. **Organic Chemistry.** (3-0-0 or 3) Cr. 3 or 4 each. 334. F.W.; 335. W.S.
Prerequisite: 103. A course in quantitative analysis is advised.
For premedical students and students majoring in biological or applied sciences. Not accepted for credit toward a degree in chemistry or chemical engineering.

347, 348. **Dairy Chemistry.** (D.I. 347, 348) Cr. 5 each.
347. (3-0-6) F.
Prerequisite: 211, 335.
Composition and changes in composition of milk in the light of milk secretion theory. The application of pH and of colloid chemistry to dairy manufacturers.
348. (3-0-6) W.
Prerequisite: 347.
Importance of milk salts, milk fat, milk fat emulsion, milk proteins and milk enzymes to the processing and keeping quality of dairy products.

374, 375. **Physiological Chemistry.** F.W.
Prerequisite: 335. For veterinary students.
374. (3-0-6) Cr. 5. Chemistry of the animal body; digestion; metabolism; nutrition.
375 (3-0-6) Cr. 5. Introduction to quantitative biochemical procedures.

403. **Qualitative Analysis.** (2-0-6) Cr. 4. W.
Prerequisite: 202.
Systematic analysis for ions except those of rare elements, with special attention to theory and the detection of negative ions. Analysis of commercial products.

425. **Colloid Chemistry.** (3 0 0) Cr. 3 Alt. S. Not offered 1953
Prerequisite: 264.
Principles of colloid chemistry and their application to various fields of home economics

426. **Radiotracer Methods.** (2-0-0) Cr. 2. F.
Prerequisite: 482 or 323 and Phys. 212
For students in biology and agriculture.
Fundamental principles of radioisotope techniques and their applications to problems in biology and allied sciences

466. **Textile Chemistry.** (2-0 0 or 6) Cr. 2 or 4 F.S.
Prerequisite: 264.
Reaction of fibers during modification and finishing.

474. **Physiological and Nutritional Chemistry.** (3-0 0 to 6) Cr 3 or 5 F.S.
Prerequisite: 333 or 335, or permission of instructor
Fundamentals of chemistry in life processes

475. **Applied Physiological and Nutritional Chemistry.** (2 0-6) Cr. 4. W.
Prerequisite: 275 or 474.
Application of quantitative procedures in interpretation of fundamentals of biochemistry.

481. **Bio-organic Chemistry.** (0-3 0) Cr. 3. F.
Prerequisite: Elementary organic chemistry.
Review and drill in organic chemistry with emphasis on applications in biology.

482. **Bio-organic Chemistry.** (0 3 0) Cr 3. W.
Prerequisite: 481 or equivalent.
Chemistry of substances of biological importance. Principles of bioassay.

483, 484. **Bio-physical Chemistry.** (3-0 0) Cr. 3 each. F.W.
Prerequisite: 256 or 265.
Introduction to fundamentals of physical chemistry, with emphasis on application to biological systems

Courses for Advanced Undergraduate and Graduate Students

501. **Inorganic Preparations.** (0 0 3 or more) Cr. 1 or more each time elected Limit 4 credits F.W.S.
Prerequisite: 202, 323. Messrs. Martin, Wilkinson
Preparation of inorganic compounds

511, 512, 513. **Advanced Quantitative Analysis.** Yr
Prerequisite: 217, 323, 333. Messrs. Banks, Diehl, Goetz
511. (0 2 0) Cr 2 F.; 512. (2-0-6) Cr. 4. W; 513. (0 0-3 to 12) Cr 1 to 4. F.W S. (511), (513) Emphasis on general methods, descriptive inorganic analysis, and current literature (512) Physical and instrumental methods of analysis.

514, 515, 516. **Analytical Emission Spectroscopy.** (Phys. 514, 515, 516)
514 (1 0 0) Cr 1 S
Prerequisite: 323, Phys 213 or permission of instructor. Mr. Fassel
Principles and methods of analytical emission spectroscopy. Qualitative detection and quantitative determination of many elements in various materials.
515. (0 0 6) Cr 2. S
Laboratory in analytical emission spectroscopy to accompany or follow 514.
516 Credit as arranged. F.W.S
Prerequisite: 515 and permission of instructor. Advanced topics on application of spectroscopic methods to problems in chemistry and related fields.

518. **Chemical Microscopy.** (1 0-6) Cr. 3 F
Prerequisite: 217, 323, Phys. 212.
Microscopic identification of elements and compounds; estimation of heterogeneous mixtures; special methods with the polarizing microscope.

519. **Quantitative Microchemical Analysis.** (1-0 6) Cr. 3 W S
Prerequisite: 217, 323, 333
Organic substances.

521, 522, 523. **Chemical Thermodynamics.** (2 0 0) Cr. 2 each Yr.
Prerequisite: 323 Mr. Griffel
Advanced discussion of the principles of classical thermodynamics

524 **Applied Surface Chemistry.** (3 0-0) Cr. 3. Alt W. Offered 1953
Prerequisite: 323. Mr. Hansen
Basic concepts of surface chemistry and their application to paints and varnishes, catalysis, wetting and detergency.

525. **Colloids and High Polymers.** (3-0 0) Cr. 3 Alt. S Offered 1953
Prerequisite: 323, 333. Mr. Foster
Physical chemistry of colloidal systems with emphasis on naturally occurring macro molecules.

526. **Radiochemistry.** (2-0-0) Cr. 2 each time taken.
Offered every third year or on request W S Not offered 1958
Prerequisite: 323. Messrs. Martin, Voigt
Natural and artificial radioactivity, sources, preparations and properties, measurement of radiations, chemistry of the radio-elements, applications of radioactive isotopes.

528. **Metallography.** (0 2 6) Cr. 4 each time taken. Limit 8 credits. Alt. F.W.
Prerequisite: 323. Not offered 1952 53
Application of physical chemistry to the study of metals and alloys with special emphasis on iron and steel.

529. **Laboratory in Radiotracer Techniques.** (0 0 6) Cr. 2. W.S.
Prerequisite: 426. Mr. Voigt
Training in measuring of radioactive substances and in their handling through chemical and biological experiments.

531. **Qualitative and Quantitative Organic Analysis.** (1-0-3 or more) Cr. 2 or more. F.
Prerequisite: 217, 333. Mr. Hammond

532, 533. **Intermediate Organic Chemistry.**
532 (2-0 0) Cr. 2. W.; 533 (2-0-0) Cr. 2. S.
Prerequisite. 531, reading knowledge of German. Mr. Hammond
Problems, abstracts, and reports on selected topics of applied and theoretical importance. Training in use of chemical literature.

534. **Laboratory Techniques of Organic Chemistry.** (0-0-3) Cr. 1. W.S.
Prerequisite: 333. Mr. Hammond
Micro-analysis and other small scale procedure.

535. **Advanced Organic Laboratory.** (0 0 3 or more)
Cr. 1 or more each time elected F.W S.
Prerequisite: 333 Mr. Gilman
Preliminary research work in synthesis and study of reactions of compounds of theoretical and industrial importance

545. **Special Topics in Food Chemistry.** (0-0 6 or more) Cr. 2 or more. F.W.S.
Prerequisite: 333 or permission of instructor. Messrs. Bird, Foster, Fox, French, Underkofler

546, 547 **Food Technology.** (Bact. 546, 547) See Bacteriology

557. **Soil Chemistry.** (Agron. 557) See Agronomy.

565. **Special Topics in Textile Chemistry.** (0-1 0 to 12) Cr. 1 to 5. F.W.S.
Prerequisite: 466. Miss Edgar
Problems in reaction of fibers.

575. **Physiological and Nutritional Chemistry.** (2-0 6) Cr. 4. W.
Prerequisite: 275 or 474
Metabolism and action of vitamins, endocrines, and inorganic elements Application of biochemical methods of analysis

576. **Special Topics in Physiological Chemistry.** (0-0-6 or more)
Cr. 2 or more each time elected. F.W S
Prerequisite: Permission of instructor.
Application of methods of physiological chemistry to specific and fundamental problems.

577. **Theoretical Physiological and Nutritional Chemistry.** (2 0 0) Cr. 2. S
Prerequisite: 475 or 575.
Modern theoretical aspects of metabolism and action of vitamins, endocrines, and inorganic elements.

584, 585. **Industrial Zymo-Chemistry.** (0 2 3) Cr. 2 or 3 each. Alt. W. S. Offered 1953
Prerequisite: 323, 333, Bact 304A. Mr Underkofler
Chemistry of fermentations, with special reference to the elaboration of chemicals and other industrial materials from agricultural products.

586. **Biochemical Laboratory.** Credit as arranged. F.W.S
Graduate staff
Cooperative development of research problems in biochemistry and related fields including research involving radioactive tracers.

591, 592, 593. **Advanced Fundamental Chemistry.** Yr.
Prerequisite: Permission of instructor Messrs Hammond, Mart Rundle
591. (4-0-0) Cr. 4. Atomic and Molecular Structure F.
592. (2-0-0) Cr. 2. Theoretical Inorganic Chemistry W.
593. (2-0-0) Cr. 2 Organic Reaction Mechanisms S

Courses for Graduate Students

601 **Selected Topics in Inorganic Chemistry.** F.W.S.
(2-0 0) Cr 2 each time elected
Prerequisite: 202, 323, 333 Messrs Brown, Martin
Structure of matter, valency, catalysis, radiations and chemical reactions.

605, 606. **Systematic Inorganic Chemistry.** (2 0 0) Cr. 2 each 605 F S. 606 F
Prerequisite: 202, 323, 333 Mr. Martin

611 **Seminar in Analytical Chemistry** (0 1 0) Cr. 1 each time elected. F.W.S.
Prerequisite: Permission of instructor. Messrs Banks, Diehl, Goetz

621. **Statistical Thermodynamics.** (2-0-0) Cr. 2 each time taken. Alt. F.W.S. Not offered 1952-53
Prerequisite: Permission of instructor. Messrs. Hansen, Shull
Review of classical and quantum mechanics, principles of statistical mechanics, applications to thermodynamics and other related problems.

622. **Quantum Chemistry.** (3-0-0) Cr. 3 each time taken. Alt. F.W.S. Offered 1952-53
Prerequisite: Permission of instructor. Messrs. Hansen, Shull
Discussion of the Schrödinger equation, solution in simple cases, perturbation and variation methods, Slater's treatment of complex atoms and molecules, valence bond and molecular orbital methods; applications.

623. **Theory of Ionic Solutions.** (2 0-0) Cr. 2. Alt. W. Offered 1953
Prerequisite: 523. Mr. Duke
Thermodynamical and statistical treatment of electrolytic solutions in water and other solvents.

624. **Theoretical Surface Chemistry.** (3-0-0) Cr. 3. Alt. S. Offered 1953
Prerequisite: An advanced course in thermodynamics or permission of instructor. Mr. Hansen
Theory of absorption, including wetting. Surface thermodynamics. Theories of catalysis and phase formation.

625. **Special Topics in Physical Chemistry.** (0-2-0) Cr. 2 each time elected. F.W.S.
Prerequisite: 323, 333 or permission of instructor. Physical Chemistry Staff
A series of one-term courses chosen from such topics as atomic, molecular and nuclear structure, surface chemistry, photochemistry, chemical kinetics, electrochemistry, phase rule.

626. **X-Ray Crystal Structure.** (Phys. 626) (2-0-0) Cr. 2 each time taken. F.W.S.
Offered every 3rd year, or on request. Must be started in fall. Not offered 1952
Prerequisite: Permission of instructor. Mr. Rundle
Lattice and symmetry properties of crystals: diffraction of X-rays by crystals; intensities of diffracted beams; application of Fourier method; examples of structures deduced from X-ray investigations.

627. **Molecular Spectroscopy.** (2 0 0) Cr. 2 each time taken Alt. Yrs. Not offered 1952-53
Prerequisite: Permission of instructor Mr. Shull
Spectra of diatomic molecules; microwave, infrared, and Raman spectra of polyatomic molecules; electronic spectra of polyatomic molecules.

628. **Chemical Kinetics.** (2-0-0) Cr. 2. Alt S. Not offered 1958
Prerequisite: 593. Mr. Duke
Theory of rate processes; application of kinetics to the study of inorganic reaction mechanisms.

631. **Advanced Organic Chemistry.** (0-1 0 or more) Cr. 1 or more each time elected. F.W.S.
Prerequisite: 531, reading knowledge of German Mr. Gilman
Description and theoretical consideration of advanced reactions. Problems, abstracts and term paper.

636, 637. **Physical Organic Chemistry.** (3-0-0) Cr. 3 each W.S.
Prerequisite: 593, or permission of instructor. Mr. Hammond
636. Application of structural theory to organic molecules
637. Reaction mechanisms with emphasis on kinetic methods.

643. **Seminar in Dairy Chemistry.** (D.I. 643) See Dairy Industry.

655. **Carbohydrate Chemistry.** (3-0-0) Cr. 3. S.
Prerequisite: Permission of instructor. Mr. French
Chemical behavior and enzymic relationships of the sugars and polysaccharides.

671. **Biochemical Preparations.** (0 1 3 or more) Cr. 2 or more each time elected. F.W.S.
Prerequisite: 275 or 474.
Isolation, preparation, and study of substances from living matter.

672. **Seminar in Physiological and Nutritional Chemistry.** (0-1-0) Cr. 1 each time elected. F.W.S
Prerequisite Permission of instructor.

674. **Protein Chemistry.** (0-3-0) Cr. 3. S.
Prerequisite: Permission of instructor. Mr. Fox
Chemistry of amino acids, peptides, and proteins.

695. **Research.**
Prerequisite: Permission of staff member concerned
Messrs. Allen, Banks, Bird, Brown, Coover, Diehl, Duke, Miss Edgar, Messrs. Fassel, Foster, Fox, French, Fulmer, Gilman, Goetz, Hammond, Hanson, Hixon, King, Martin, Miss Naylor, Messrs Rogers, Rundle, Shull, Spedding, Underkofler, Voigt, Wilhelm, Wilkinson.

Child Development

GERTRUDE E. CHITTENDEN, Ph.D., Head of Department

Professors: Lydia V. Swanson, M.S.; Thomas Franklin Vance, Ph.D.

Associate Professors: Glenn R. Hawkes, Ph.D.; Alma H. Jones, M.S.; Edith M. Sunderlin, M.A.

Assistant Professor: Anita Marie Morton, M.A.

Instructors: Cobb, Cox, Gamble, Gould, Hansen, LaVanway, Wiltgen

Opportunities for Undergraduate Study

For undergraduate curriculum in child development leading to the degree of Bachelor of Science, see page 132.

The child development curriculum provides specialized training for professional work with children. Opportunities to observe and work with infants, nursery school children and school age children are offered.

Specialization in this department prepares students for nursery school teaching and administration and for leadership in educational programs of children's institutions.

Students interested in preparing for the position of Junior Child Welfare worker, for graduate work leading to positions in extension or college teaching in the areas of child development and family relations, or to positions with child and family welfare agencies may register in the child development department and arrange a special curriculum on consultation with the Dean of Home Economics and the head of the child development department.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in child development, and minor work to students taking major work in other departments. The graduate program in this department is planned in coordination with that of the Iowa Child Welfare Research Station of the State University of Iowa.

Students taking major work in child development may select their minors in home economics education, home management, psychology or sociology.

It is recommended that the student have a general background in home economics, but students with undergraduate training in psychology or sociology may be accepted.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: 436, 440, 466, 467, 480.

Description of Courses

Courses Primarily for Undergraduate Students

235. **Children in the Home.** (0-2-3) Cr. 3 F.W.S.
Prerequisite: Psych. 215.
Principles of development and guidance of children as applied in home situations. Observation and participation in the nursery school and other situations involving children.

300. **Introduction to Family Relationships.** (0-3-0) Cr. 3 F.W.S
Prerequisite: Psych. 204 or 215; Soc. 234C.
Interrelations of the individual and his family.

330. **Home Play for Children.** (0-2-3) Cr. 3. F
Prerequisite: 235, 300. Not open to Child Development majors
Choice and guidance of children's play activities in the home and neighborhood.

340. Literature for Children. (0 3-0) Cr. 3. S
Prerequisite: 235.
Books, stories, poetry and verse for children from two to twelve years of age.

436. Development in Early Childhood. (0 2-3) Cr. 3. F.
Prerequisite: 235, 300.
Social, emotional and intellectual development of children from birth to five years.

440. Play and Play Materials in the Nursery School. (0-2-3) Cr. 3. W.
Prerequisite: 436.
Planning for play activities in the nursery school.

465. Seminar. (0-2-0) Cr. 2. F.W.S.
Prerequisite: 436, Psych. 516
Preparation and presentation of reports on original investigations in child development.

466 Methods of Nursery School Teaching. (0-3-3) Cr. 4. S.
Prerequisite: 440.
Curriculum planning for the nursery school, including home-school relations. Observation of nursery school teaching.

467. Supervised Teaching in the Nursery School. (0-1 12) Cr. 5. F.W.S.
Prerequisite: 466.
Experience in teaching a group of nursery school children for a period of six weeks

480. Guidance in Later Childhood. (0 2 3) Cr 3 F W.S.
Prerequisite: 235, 300
For home economics education students only. Developmental characteristics of children from six to twelve years of age, with implications for guidance.

Courses for Advanced Undergraduate and Graduate Students

536. Development in Later Childhood. (0 2 3) Cr 3 S
Prerequisite: 436 Miss Chittenden
Social, emotional and intellectual development of children from six to twelve years of age.

546. Community Factors in Development of Children and Families. (0 2 3) Cr. 3. W.S
Mr Hawkes
Prerequisite Soc. 234C, six credits in child development and senior classification
Resources of the community as they relate to the welfare of the child and his family
Field trips to acquaint students with community agencies

555. Special Topics. F.W S
Prerequisites 9 credits in child development. Misses Chittenden, Sunderlin, Swanson, Messrs. Hawkes, Vance

558 Nursery School Planning. (0 2-3) Cr. 3. W.
Prerequisite: 466. Misses Sunderlin, Swanson
Essential procedures in nursery school organization including housing, equipment, food service, health protection and supervision; analysis of responsibilities of a head teacher.

567. Development in Infancy. (0 2 0) Cr 2 F
Prerequisite: H Mgt 475, Zool 458 Miss Swanson
Developmental characteristics during the first eighteen months with implications for guidance and care

Courses for Graduate Students

614. Research. F.W.S.
Miss Chittenden, Mr. Vance

655. Planning College Courses in Child Development. (0 3-0) Cr. 3.
Alt. W. Not offered 1953
Prerequisite: 467 or equivalent. Miss Swanson
Selection, organization, presentation of subject matter
Evaluation of student growth.

660 History and Philosophy of Nursery School Education. (0-3-0) Cr. 3. Alt F
Prerequisite: 466. Offered 1952. Mr. Vance
Theories of early childhood education; history of the nursery school movement

665. Seminar. Credit as arranged. F.W S
Misses Chittenden, Swanson, Mr. Vance

666. Nursery School Organization. (0-2 0) Cr. 2. Alt. S. Offered 1953
Prerequisite: 660. Miss Chittenden
Administration of nursery schools. Emphasis on plant, budget, staff, public relations.

Civil Engineering

LOWELL O STEWART, M S, C E., Head of Department

Professors: Robert Andrew Caughey, C.E.; Ladis H. Csanyi, M.S.; Almon Homer Fuller, Sc.D.; Frank Kerekes, C E ; William J. Schlick, C.E.; Merlin G. Spangler, M.S.; Robley Winfrey, C.E.

Associate Professors: William Carl Alsmeyer, Ph.D., Donald T. Davidson, Ph.D.; William Edward Galligan, M.S.; Rudolph John Lubsen, M.S.; James P. Michalos, Ph D.

Assistant Professors. Wilfred Toman Hosmer, M S , Cornie Leonard Hulsbos, M S ; Herbert Ordell Ustrud, M.S.

Instructors Chu, Girton, Sheeler, *Taft

Opportunities for Undergraduate Study

For undergraduate curriculum in civil engineering leading to the degree of Bachelor of Science, see page 120.

Civil engineering consists of the economic application of the laws, forces, and materials of nature to the design, construction, maintenance and operation of public works; also the research, testing, sales, management, and other functions that are related thereto. The public works include transportation; bridges and buildings; water supply, sewerage, irrigation, and drainage systems; river and harbor improvements; dams and reservoirs; surveys and maps.

Work on the campus is supplemented by a six weeks summer camp which follows the sophomore year, and by inspection trips which furnish an opportunity for first-hand study of engineering work and industrial plants.

Opportunities for Graduate Study

The department offers work for the degree of Master of Science in sanitary, structural, municipal, highway, soil, and transportation engineering; and major work for the degree of Doctor of Philosophy in structural, sanitary, soil, and highway engineering; and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of a curriculum substantially equivalent to that required of undergraduate students in civil engineering at this institution, and including undergraduate courses necessary for the particular field chosen.

Students who major in civil engineering will usually select minor work from the departments of mathematics, physics, chemistry, bacteriology, geology, economics, or other engineering departments.

Open to graduate students for minor only: 331, 355, 356, 360, 364, 404, 406, 421, 422, 423, 432, 433, 434, 485, 490.

Description of Courses

Courses Primarily for Undergraduate Students

100. Technical Lecture. (1-0-0) Required. **S.**
Discussion of various phases of civil engineering Lectures by staff members and practicing civil engineers.

211. Elementary Surveying. (0-2 9) Cr. 5. **F.**
Prerequisite: Math. 102.
Theory and practice in use of tape, compass, level, transit for surveying problems; topographic surveys by transit stadia.

*On leave

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212. Topographic and Cadastral Surveying. (0-1-6) Cr. 3. W.
Prerequisite: 211.
Mapping from stadia and aerial surveys; areas, volumes, simple curve problems; land surveying. Elementary photogrammetry.

218. Route and Higher Surveying. (0-2-6) Cr. 4. S.
Prerequisite: 212.
Theory and field practice in curve, spiral, and earthwork problems; field astronomy; underground, hydrographic, geodetic, and city surveys.

300. Summer Camp. Cr. 9. SS.
Prerequisite: 218.
Engineering field practice in camp. Land, topographic, route, and hydrographic surveying. The student pays his own transportation and living expenses and the regular summer quarter registration fee.

310. Elementary Surveying. (0-1-9) Cr. 4. F.
Prerequisite: Math. 102.
Theory and practice in use of tape, compass, level, transit for surveying problems; topographic surveys by transit stadia.

312. Surveying and Map Making. (0-2-6) Cr. 4. W.
Prerequisite: 310.
Calculations for route surveys and volumes. U. S. Public Land Surveys, map making. Elementary photogrammetry.

313. Surveying. (0-1-6) Cr. 3. S.
Prerequisite: 312.
Triangulation, plane-table, route surveys, field astronomy.

325. Surveying. (0-1-6) Cr. 3. F.S.
Prerequisite: Math. 102.
Pacing, chaining, leveling, traversing, simple topography, care and use of instruments. Designed for students who take no sequence courses in surveying.

331. Elements of Structures. (0-3-6) Cr. 5. F.W.S.
Prerequisite: T.&A.M. 324, credit or classification in T.&A.M. 358 or its equivalent.
Analysis, design and cost estimates for simple tier buildings, girders, and trusses of steel, reinforced concrete and timber. Economic selection and specifications.

354. Roads and Pavements. (0-3-0) Cr. 3. F.
Prerequisite: 213 or 325.
Types of roads and pavements, methods of design, construction, maintenance, special machinery, costs, comparisons, financing, administration, traffic.

355. Highway and Airport Pavements. (0-2-6) Cr. 4. W.
Prerequisite: 360.
Theory and practice in design, construction, and maintenance of low cost, intermediate, and high type highway and airport pavements. Stabilization of bases and pavements. Laboratory tests of aggregates, bituminous materials, and Portland Cement Concrete and bituminous pavements.

356. Highway and Street Design. (0-3-0) Cr. 3. W.S.
Prerequisite: 213.
Highway administration and finance; location and geometric design; traffic surveys and traffic control; maintenance.

360. Soil Engineering. (0-3-6) Cr. 5. F.W.
Prerequisite: Classification in T.&A.M. 324.
Origin, structure, identification, and classification of soils for engineering purposes. Determination and application of their physical properties Elementary hydromechanics of soils and principles of shearing resistance, deformation characteristics, consolidation, and compaction.

364. Railway Engineering. (0-2-3) Cr. 3. W.
Prerequisite: 213.
Railway location and design problems. Stringlining curves. Construction, maintenance, and operation problems of the railway engineer.

394, 395. Technical Development. Required. F.S.
Oral reports and discussions on engineering organizations, technical societies, government bureaus, notable engineering projects, and related topics.

400. Senior Inspection Trip. Required. F.
Prerequisite: Senior C.E. classification.
An inspection trip of one week to Chicago, St. Louis or other suitable place.

404. Engineering in City Planning. (0-3-0) Cr. 3. W.
Prerequisite: Classification in L.A. 401 or senior engineering classification.
Relation of sanitary works, transportation, and other utilities to city planning; housing, building codes, real estate sub-division, land titles.

406. Aerial Photogrammetry. (0-1-6) Cr. 3. W.
Prerequisite: 212 or 312.
Mapping by use of aerial photographs. Preparation of map and controlled mosaic from photographs of area near campus.

421. Hydrology and Water Power Engineering. (0-2-6) Cr. 4. S.
Prerequisite: Credit or classification in T.&A.M. 378.
Elements of hydrology, precipitation, water losses and stream flow. General plan of hydroelectric power plant.

422. **Sewerage and Sewage Treatment.** (0 2-6) Cr. 4. F.
Prerequisite: T.&A.M. 378, Bact. 304D.
Design of sanitary, storm and combined sewers. Relationship of sewage treatment to stream pollution abatement. Principles of sewage treatment plant design.

423. **Water Supply.** (0-2-6) Cr. 4. W.
Prerequisite: T.&A.M. 378, Bact. 304D.
Collection, treatment and distribution of water for public, domestic, and industrial uses. Design of water supply works.

432. **Continuous-Frame Structures.** (0 3 6) Cr. 5. W.S.
Prerequisite: 331.
Analysis and design of continuous-frames and arch ribs for buildings and bridges of steel, reinforced concrete, and timber. Curved beam, moment-area and moment-distribution principles. Deflections. Specifications and economic selection.

433. **Truss-Frame Structures.** (0-3-6) Cr. 5. W.S.
Prerequisite: 432.
Analysis and design of statically determinate and indeterminate bridges and industrial buildings. Steel and timber structures. Moving loads. Economic factors. Deflections and camber. Specifications. Investigation of an existing structure.

434. **Foundations and Masonry Structures.** (0-3-6) Cr. 5. W.S
Prerequisite: 433.
Analysis, design and construction of masonry structures and foundations, including dams, retaining walls, buttresses for building walls, underground conduits, building foundations, bridge piers and abutments, waterway requirements, pile foundations, tanks and bins. Behavior of soils under load.

484. **Engineering Reports.** (0-3-0) Cr. 3. W.S.
Prerequisite: Senior classification.
Content and form of engineering reports; collection, assembly and interpretation of data; preparation of papers, letters, and reports.

485. **Engineering Construction.** (0-3-3) Cr. 4. F.W.S.
Prerequisite: 331.
Fundamentals of successful construction management; construction methods and equipment, form design, estimating, inspection trips to local projects. Engineering inspection, and direction of contract work.

490. **Advanced Civil Engineering.** (By conf.) Cr. 3 to 6. F.W.S.
Prerequisite: Permission of department.
Any phase of civil engineering in which the student has done exceptionally strong work.

496, 497. **Professional Development.** Required. F.W
Biographical sketches of prominent engineers: ethics; registration; professional organizations.

Courses for Advanced Undergraduate and Graduate Students

505. **Public Works Engineering.** (0 3-0) Cr. 3. S.
Prerequisite: 422 or 423. Mr. Stewart
Job classification and specification; construction contracts and specifications; unit costs; special assessments; building codes; fire protection; refuse collection and disposal; street and work maintenance.

521. **Field Hydrology.** (0-2-3 to 12) Cr. 3 to 6. F.
Prerequisite: 421. Mr. Galligan
Field observations of precipitation, water losses and stream flow. Use of statistical methods in field.

522. **Sewage Analysis and Special Problems.** (0-2-3 to 12) Cr. 3 to 6. F.S.
Prerequisite: 422. Mr. Galligan
Sewage and industrial waste chemical analysis. Experiments on sludge digestion and filtration.

523. **Water Analysis and Water Treatment Plant Design.** (0-2-3 to 12) Cr. 3 to 6. W.
Prerequisite: 423. Mr. Galligan
Quantitative determination of minerals and gases in water and design of appropriate treatment works.

524. **Multiple Use of Water Resources.** (2-0-3 to 12) Cr. 3 to 6. W
Prerequisite: 521. Mr. Galligan
Social and economic phases of governmental participation in Federal Public Works programs related to the field of hydrology. Project study with reference to power, irrigation, navigation and flood control.

530. **Industrial Buildings.** (0-2-3) Cr. 3. W.
Prerequisite: 432 and permission of head of department
Messrs. Alsmeyer, Caughey, Kerekes
Economic layouts, types and details of construction, analysis, and design. Arched roof, continuous truss and rigid frame types.

531. **Multistory Buildings.** (0-2-3) Cr. 3. S
Prerequisite: 432 and permission of head of department.
Messrs. Alsmeyer, Caughey, Kerekes
Analysis and design. Determination of design loads and their distribution. Design of special as well as regular features. Economic selection

534. **Rigid Frames.** (0-3-0) Cr. 3 F.
Prerequisite: 432 and permission of head of department. Messrs. Alsmeyer, Caughey
Rigid frame analysis based upon curved beam theory, slope deflection, moment distribution, column analogy, strain energy and Beggs model method

536. **Bridge Design.** (0-2 3) Cr. 3. S.
Prerequisite: 433 and permission of head of department.
Messrs. Alsmeyer, Caughey, Fuller
The bridge as a unit in a transportation system. Clearance requirements for traffic. Economic principles governing the design and relationship of trusses, girders, floors, and bracing Advantages and limitations of continuous structures. Aesthetic features.

537. **Storage Structures.** (0-3 0) Cr. 3. F.
Prerequisite: 432 and permission of head of department. Messrs. Alsmeyer, Caughey
Load behavior, methods of stress analysis and design of walls, bins, tanks, dams, silos and retaining walls.

538. **Model Analysis of Structures.** (0 1 6) Cr. 3. W.
Prerequisite: 432 and permission of head of department. Mr. Kerekes
Theoretical and experimental model analysis of structures. Use of devices and mechanisms for measuring load effects on plane and space structures

550. **Traffic Engineering.** (0 3-3) Cr. 4. F.
Prerequisite: 356. Messrs. Csanyi, Winfrey
Principles of highway and street traffic movements; driver and vehicle performance; traffic analysis and traffic control; parking; lighting.

551. **Highway Economics and Costs.** (0-3 0) Cr. 3. S.
Prerequisite: 355, 356. Mr. Winfrey
Economics of grades, location, roadway surfaces and traffic controls Cost accounting, transportation costs, and cost allocations to beneficiaries.

552. **Bituminous Paving Materials.** (3-0-0) Cr. 3. F.
Prerequisite: 355. Mr. Csanyi
Source, manufacture, processing, types, constituents, tests, chemical behavior, specifications, and uses of bituminous materials and aggregates in pavements.

560. **Advanced Soil Engineering.** (0 3-3) Cr. 4. W
Prerequisite 360. Messrs. Davidson, Spangler
Shearing resistance, consolidation, compaction, settlement, and displacement Stress distribution in soil masses. Theory of pile supporting strength. Seepage. Application of principles of soil mechanics to earthwork, foundations, and highway problems. Soil surveying, profiling, sampling, and testing.

574. **Airport Design.** (0 3 3) Cr. 4. S.
Prerequisite: 355, 356. Messrs. Davidson, Stewart
Growth and development of air transport. Its regulation and administration. Factors influencing location, design; soil engineering, runway design, construction, maintenance of airports, layout of field lighting plans, terminal facilities, hangars and accessory structures. Finance, legislation and zoning problems.

585 **Highway Construction Methods.** (0 3 0) Cr 3. S.
Prerequisite: 355, 485. Messrs. Csanyi, Hosmer
Methods and equipment used in processing materials and constructing highways and their appurtenances; scheduling and controlling operations; compliance with specifications.

586 **Heavy Construction Methods.** (3 0-0) Cr 3 F.
Prerequisite: 485. Messrs. Csanyi, Hosmer
Methods and equipment employed in heavy construction including pile, caisson, heavy foundations, piers, coffer dams and riverworks, heavy concrete structures, retaining walls, tunneling and dam projects

590. **Special Topics.** Cr. 1 to 5 each time elected. F.W.S.
Messrs. Alsmeyer, Caughey, Csanyi, Davidson, Fuller, Galligan, Hosmer, Kerekes, Michalos, Schlick, Spangler, Stewart, Winfrey

Courses for Graduate Students

606. **Municipal Management.** Cr. 3 to 6. F.
Mr. Stewart
Utility management, planning improvements, sources of funds, labor relations, public relations, coordination of departments

620. **Seminar.** Required.
Mr. Stewart

621. **Sanitary Engineering and the Public Health.** Cr. 4 F.
Mr. Galligan
The sanitary engineer's responsibility in the field of public health and hygiene. Organization, administration and operation of public health agencies

622. **Sewage and Industrial Waste Treatment.** Cr. 3 to 6 W.
Mr. Galligan
Critical analysis of design and operation of existing sewage treatment plants.

623. **Water Treatment and Other Water Problems.** Cr. 3 to 6. S
Mr. Galligan
Critical analysis of design and operation of existing water treatment plants.

636. **Load and Stress Distribution in Structures.** Cr. 3 to 6. W.
Messrs. Caughey, Fuller
Relation between actual and specified loads, including impact. Transfer of loads from points of application to the foundation. Distribution of stresses within a member. Secondary stresses. Principles of designing to insure a favorable stress condition. Limit design.

643. **Concrete and Block Pavements.** (0-3-0) Cr. 3. F.
Prerequisite: 550. Mr. Csanyi
Analysis of problems encountered in the use and maintenance of concrete in pavements, including the chemical and physical aspects. Brick and other block paving materials.

644. **Space Frames.** Cr. 3 to 6. F.W.S.
Mr. Kerekes
Analysis of complete structures in three planes, including the continuous frame and the truss-frame types. Interpretation of load, strain and displacement measurements.

645. **Concrete Pavement Slabs.** Cr. 3 F.W.S.
Prerequisite: 648 or permission of instructor. Messrs. Caughey, Spangler
Analysis of stresses in highway pavements under various subgrade conditions. Interpretation of behavior of slabs in laboratory and in service.

646. **Dynamic Analysis of Structures.** Cr. 3 to 6. F.W.S.
Mr. Kerekes
Theoretical and experimental studies of the dynamic effects upon structures caused by machines, vehicles, impact loads, wind and earthquake.

652. **Bituminous Pavement Design.** (3 0-3) Cr. 4. W.
Prerequisite: 552. Mr Csanyi
Theory and practice in design and manufacture of bituminous paving mixtures and construction of bituminous pavements. Laboratory tests for design and their correlation to service behavior.

653. **Street and Urban Highway Design.** Cr. 3. W.
Prerequisite: 550. Mr Csanyi
Design of city streets, involving cross section, intersections, subsurface utilities, on and off street parking, mass transportation, loading facilities, widening, channelization, drainage, and markings; design of urban expressways, service roads and their relationship to basic street system.

654. **Highway Location and Design.** Cr. 4. F.
Prerequisite: 550. Messrs. Csanyi, Winfrey
Route selection, geometric design, economic aspects, traffic capacity, and roadway appurtenances of non urban roads and highways.

655. **Highway Administration and Finance.** Cr. 3. W.
Prerequisite: 551. Mr. Winfrey
Organization and function of highway department's administrative procedures; financial plans, revenues, budgets and controls; sources of revenue.

659. **Highway Specifications.** Cr. 3. S.
Messrs Csanyi, Spangler
Preparation of specifications for highway improvements in accordance with state and national standards.

660 **Foundations and Underground Structures.** Cr. 3. S.
Prerequisite: 560. Messrs. Caughey, Davidson, Spangler
Design of substructures to meet various soil conditions. Piles and pile driving. Settlement of structures. Theory of loads and supporting strengths of sewers, water mains, gas lines, culverts, tunnels. Pressures on retaining walls and open cut sheathing.

661 **Highway Soil Engineering.** Cr. 4. S.
Prerequisite: 560. Messrs. Davidson, Spangler
Stability of highway embankments, compaction of soils and subsidence. Design of flexible pavements. Subgrade bearing capacity, subgrade drainage, frost action, and related phenomena.

663 **Earth Dams.** (0 3 3) Cr. 4 W
Prerequisite: 560. Messrs. Davidson, Spangler
Location, selection of material, design and construction of earth dams.

664, 665, 666. **Theory and Methods of Soil Stabilization.** (3-0 0) Cr 3 each. Yr.
Prerequisite: 560. Mr. Davidson
Fundamental concepts of the nature and properties of engineering soils. Application of principles of soil mechanics, soil physics, soil chemistry, mineralogy and physicochemical reactions between soils and soil additives to the stabilization of soils for engineering usage.

668. **Planning Highway Transportation Systems.** Cr. 3. S.
Prerequisite: 550. Messrs. Csanyi, Winfrey
Fundamentals and coordination of transportation systems. Regional planning, planning surveys, designation of road and street systems. Mass transportation and location and type of urban facilities.

671, 672, 673. **Theory of Structural Design and Analysis.** (3-0 0) Cr. 3 each. Yr.
Mr. Michalos
Theories of structural action and their application to the design of bridges, building frames, rigid frames, pavement slabs, shells, floor slabs, arches and aircraft. Classical and modern methods of analysis, including formalized procedures and methods of successive approximation.

690 **Research.** Messrs. Caughey, Csanyi, Davidson, Fuller, Galligan, Kerekes, Michalos, Schlick, Spangler, Stewart, Winfrey

Climatology and Meteorology

The Iowa State College offers a wide range of work in climatology and meteorology.

Opportunities for Undergraduate Study

Physics 305 and 306 are designed to furnish orientation and descriptive information for undergraduates interested in meteorology and climatology. These courses are independent of each other. Students majoring in physics, mathematical statistics, engineering, or agronomy may specialize in meteorology or climatology, preparing for positions in various governmental departments, industrial climatology, agricultural climatology, aviation, or the several branches of engineering in which the knowledge is desirable or required For such students, Physics 324, 325, and 334 constitute a highly recommended sequence. This sequence also furnishes the background required for graduate study in climatology. Additional courses to round out the student's training may be chosen from offerings such as those in geology, agronomy, physics, statistics, or engineering (civil, mechanical, aeronautical), depending upon the student's individual interests.

Opportunities for Graduate Study

Graduate work is offered for the degree of Master of Science in the field of climatology. Students with the necessary prerequisites may major in agricultural climatology.

Prerequisite to major graduate work in any field of climatology is the satisfactory completion of a suitable undergraduate curriculum, including five quarters of college mathematics through differential and integral calculus; a year of college physics based upon a year of college mathematics, specifically courses in Physics 211, 212, 213 or Physics 221, 222, 223; three quarters (one year) of chemistry; three quarters (one year) of meteorology, including physical meteorology (with laboratory work in map and chart analysis), dynamic meteorology (see Physics 324, 325, and 334) and one quarter of statistics. Also desirable are an elementary course in geology, one in climatology, and one in hydrology.

Prerequisite to work in the field of agricultural climatology is the completion of the following:

Agronomy 111, 112, 234, 354, 464

Botany 101, 205, 206, 424

Dairy Husbandry

For description of courses, see Department of Animal Husbandry, page 173.

Dairy Industry

CARROLD ARTHUR IVERSON, M.S., Head of Department

Professors: Emerson W. Bird, Ph.D.; Emery Fox Goss, M.S.; Martin Mortensen, B.S.; Frank Eugene Nelson, Ph.D.; Arthur W. Rudnick, B S.

Associate Professors: Merle Porter Baker, Ph.D.; Wilber John Caulfield, M.S.

Assistant Professors: Darrell Dwight Deane, Ph.D.; Robert Charles Fincham, B.S.; Verner Henry Nielsen, B.S.; Winfield S. Rosenberger, B.S.; A. F. Tamsma, Ph D.; Karl Wester, B.S.

Instructors: Blake, Fortney, Graham

Opportunities for Undergraduate Study

For undergraduate curriculum in dairy industry leading to the degree of Bachelor of Science, see page 100. For undergraduate curriculum in dairy industry with major in dairy industry and chemistry and in dairy industry and economics, see page 101. For the four-quarter program in dairy plant operation, see page 109.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in dairy plant management, dairy bacteriology, dairy chemistry, and manufacture of dairy products; major work for the degree of Doctor of Philosophy in dairy bacteriology and dairy chemistry in cooperation with the basic science departments; and minor work to students taking major work in other departments.

Students expecting to major in dairy industry should have undergraduate training substantially equivalent to that required of undergraduate students in the curriculum in dairy industry at this institution.

Open to graduate students for minor only: 304, 305, 306, 347, 348, 350, 402, 404, 450.

Description of Courses

Course Primarily for Noncollegiate Students

27. **Farm Dairying.** (0-2-3) Cr. 3. W.
Separation, care of milk and cream, and milk testing

Courses Primarily for Undergraduate Students

110. **Technical Lectures.** (1-0-0) Required. S.
Field of dairy industry, its opportunities, requirements, and organization.

114. **Elements of Dairying.** (3-0 3) Cr. 4. F.W.S.
Development and organization of dairy industry, composition and properties of milk, methods of manufacturing dairy products and improving their quality.

116. **Testing and Inspection of Milk and Its Products.** (3 0 0 or 6) Cr. 3 or 5. W.
Prerequisite: 114.
Tests for fat, solids, acidity preservatives used in dairy plant and milk control laboratory; use of Mojonnier tester.

152, 153 **Dairy Technology.** (0 2 3) Cr. 3 each For students in Dairy Plant Operation. F W.
Technical control of dairy products.

154, 155. **Dairy Practice.** For students in Dairy Plant Operation F.W
154. (0-0-12) Cr. 4. F ; 155. (0 0-12) Cr 4 W.
Manufacture of butter, cheese, and ice cream. Market milk plant operation, preparation of starters, testing milk and milk products and refrigeration plant operation.

156. **Testing Milk and Milk Products.** (0 2-6) Cr. 4. F.
For students in Dairy Plant Operation.
Composition of milk. Babcock test and various other tests employed in dairy manufacturing plants.

157. **Butter Manufacture.** (0 4-0) Cr. 4. For students in Dairy Plant Operation. W.
Quality of milk and cream, separation of milk, cream ripening, starters, churning, and preparing butter for market.

158. **Ice Cream and Ices.** (0-3-0) Cr. 3. For students in Dairy Plant Operation. W.
Selection and preparation of materials, processing and merchandising of plain and fancy ice creams and related products.

159. **Cheese Manufacture.** (0-3 0) Cr. 3. For students in Dairy Plant Operation. W.
Principles of cheese manufacture. Soft cheese, cheddar, and other cured cheese; manufacture, curing, and marketing.

207. **Judging Dairy Products.** (0-0-3) Cr. 1 W.
Milk, cheese, butter, and ice cream.

215. **Cheese Manufacture.** (3-0 6) Cr. 5. S.
Prerequisite: 114.
Selection of milk; manufacture and curing raw and pasteurized milk cheddar; cream, Neufchatel, and cottage; marketing.

256. **Market Milk.** (0 3-0) Cr. 3. For students in Dairy Plant Operation. F.
Methods used in preparation of milk and cream for market

258. **Condensed and Powdered Milk.** (0-2-3) Cr. 3. W.
For students in Dairy Plant Operation.
Manufacture of condensed and powdered milk.

260 **Dairy Plant Management.** (0-4 6) Cr. 6. F.
For students in Dairy Plant Operation
Underlying principles of management of creameries and other dairy plants.

264 **Special Problems.** (0-2 4) Cr. 2. For students in Dairy Plant Operation. F
Use of original sources of dairy information, written and oral reports, laboratory practice.

265. **Dairy Bacteriology.** (0-3-9) Cr. 6. For students in Dairy Plant Operation. F.
Importance of bacteria in dairy products. Determination of numbers and types of bacteria in dairy products and their significance.

304. **Manufacture of Butter.** (3-0-6) Cr. 5. S.
Prerequisite: 116, 350 except for Dairy Husbandry students.
Separation of milk for buttermaking, preparation of starters, ripening, and churning of cream.

305. **Market Milk.** (0-3 6) Cr 3 or 5. S.
Prerequisite: 116, 350.
Sanitary production and processing of milk supply; milk inspection systems and marketing of milk.

306. **Manufacture of Ice Cream and Ices.** (3-0-6) Cr. 5. S.
Prerequisite: 116, 350.
Care and preparation of materials used Plain and fancy ice creams and related products.

308, 309. **Judging Dairy Products.** (0-0-3) Cr. 1 each W.S.
Milk, cheese, butter, and ice cream

347, 348. **Dairy Chemistry.** (Chem. 347, 348)
347. (3 0-6) Cr 5 F.
Prerequisite: Chem. 211, 335.
Composition and changes in composition of milk in the light of milk secretion theory. The application of pH and of colloid chemistry to dairy manufactures.
348. (3-0-6) Cr. 5 W.
Prerequisite: 347.
Importance of milk salts, milk fat, milk fat emulsion, milk proteins and milk enzymes, to the processing and keeping quality of dairy products.

350. **Dairy Bacteriology.** (Bact. 350) (3-0-0 or 6) Cr. 3 or 5. W.
Prerequisite: Bact. 304A.
Bacteria in milk and its derivatives; hygienic production and handling of dairy products.

402 **Marketing Dairy Products.** (Econ 402) (0-3 0) Cr. 3. W.
Prerequisite: Econ. 355, D.I. 114
Economic problems in procuring milk and cream, in processing and distributing fluid milk, cream and manufactured dairy products; efficiency analysis, quality, marketing legislation, market news, market methods, including cooperation, consumer demand and price policy

404. **Condensed Milk Products.** (0 3 3) Cr 4. F.
Prerequisite: 116, 348.
Manufacture of condensed and powdered milk, casein, and milk sugar

405 **Seminar.** (2 0 0) Cr. 2. F.
Prerequisite: 350
Advance work in dairy problems and reviews of experiment station work.

407. **Special Problems in Dairy Manufacturing.** (0 0-6 or 9) Cr. 2 or 3. S.
Prerequisite: Senior college classification and quality point average of 2.5 or more for preceding two quarters.
Advanced work in dairy products manufacturing

408. **Dairy Industry Travel Course.** Cr. 4
Prerequisite: Senior college D.I. classification.
Tour and study of dairy manufacturing and marketing facilities of certain sections of the United States

450. **Special Dairy Bacteriology.** (Bact. 450) Cr. 2 to 6. F.W.S.
Prerequisite: 350, senior college classification and quality point average of 2.5 or more for preceding two quarters
Laboratory investigations, assigned readings, and reports on bacteriological problems relating to dairying.

491, 492, 493 **Dairy Plant Equipment.** (A.E. 491, 492, 493) See Agricultural Engineering

Courses for Advanced Undergraduate and Graduate Students

504. **Management of Dairy Plants.** (0-5 0) Cr. 5 W.
Prerequisite: 304, 305, 306. Mr. Mortensen
Organization, construction, and operation of dairy establishments.

508. **Foreign Varieties of Cheese.** (2-0 3) Cr. 3. S.
Prerequisite: 215. Mr. Goss
Selection of milk, manufacture, curing, and marketing of Swiss, brick, Limburger, Roquefort, Camembert. Special attention given to cultures and control of curing.

509 **Advanced Cheese Manufacture.** (2 0 3) Cr. 3. Alt Yrs. Not offered 1952 53
Prerequisite: 215 or equivalent, 559 Mr. Goss
The application of chemistry and bacteriology to cheese manufacturing.

558. **Milk Inspection.** (Bact. 558) (2 0 6) Cr. 4. S.
Prerequisite: Credit or classification in 305. Mr. Baker
Supervision of municipal milk and ice cream supplies from standpoint of sanitation.

559. **Bacteriology of Butter and Cheese.** (Bact. 559) (3-0-0 or 6) Cr. 3 or 5. F.
Prerequisite: 350. Mr. Nelson
Bacteriological changes occurring in cream intended for buttermaking and in butter and cheese.

599. **Dairy Production in Foreign Counties.** (0 2 0) Cr. 2. Alt. S. Not offered 1953
Prerequisite: 504. Mr. Mortensen
Development of dairying in various countries and world markets for dairy products.

Courses for Graduate Students

643. **Seminar in Dairy Chemistry.** (Chem. 643) (0 1-0) Cr. 1 each time elected. F.W. Mr. Bird

655. **Conference in Dairy Bacteriology** (Bact. 655) (2-0 0) Cr. 2. W.
Mr. Nelson
Discussion of bacteriological problems relating to various phases of dairying.

656. **Identification of the Organisms Common in Dairy Products.** (Bact. 656) (1-0-9) Cr. 4. W.
Mr. Nelson
Identification and relationships of desirable and undesirable organisms commonly encountered in dairy products.

659. **Seminar.** (1-0-0) Cr. 1. F.
Mr Nelson
Use of dairy literature. Methods of keeping abstract and reprint files, preparation of theses and similar technical manuscripts.

660. **Seminar.** (1 0-0) Cr. 1. S.
Messrs. Bird, Nelson

690. **Research.**

A. Manufacture of Butter.	Messrs. Bird, Mortensen
B. Manufacture of Ice Cream.	Messrs. Bird, Caulfield, Iverson
C Dairy Bacteriology. (Bact 690C)	Messrs. Baker, Nelson
D. Market Milk.	Mr. Nelson
E. Manufacture of Cheese	Messrs. Bird, Goss
F. Management of Dairy Plants	Messrs Goss, Mortensen
G. Dairy Chemistry	Mr. Bird

Economics and Sociology

WILLIAM GORDON MURRAY, Ph.D., Head of Department

Professors: Harold W. Davey, Ph.D.; David Fulcomer, Ph.D.; Joseph B. Gittler, Ph.D.; Earl O. Heady, Ph.D.; Elizabeth Ellis Hoyt, Ph.D.; Margaret Isabel Liston, Ph.D.; Walter A. Lunden, Ph.D.; Carl Malone, B.S.; Frank Robotka, M.S.; William H. Schrampfer, J.D.; Geoffrey Seddon Shepherd, Ph.D.; Sam H. Thompson, Ph.D.; William H. Thompson, Ph.D.; John F. Timmons, Ph.D.; Gerhard Tintner, Ph.D.; Ray E. Wakeley, Ph.D.; James J. Wallace, B.S.; Wallace Wright, Ph.D.

Associate Professors: Ira W. Arthur, Ph.D.; Raymond R. Beneke, Ph.D.; Ronald C. Bentley, M.S.; Edna Douglas, Ph.D.; Everette N. Hong, Ph.D.; Herbert B. Howell, M.S.; Donald R. Kaldor, Ph.D.; Francis A. Kutish, M.S.; John A. Nordin, Ph.D.; Wallace Elmer Ogg, Ph.D.; William R. Parks, Ph.D.; William H. Stacy, Ph.D.

Assistant Professors: Henry H. Albers, Ph.D.; Jesse B. Allen, M.S.; George M. Beal, M.S.; Leonard J. Bodensteiner, B.S.; Joe M. Bohlen, M.S.; Donald W. Brown, C.P.A.; Thomas L. Cook, M.S.; Harland N. Doughty, M.S.; John Ronald Frazer, M.S.; Howard Harry Hines, Ph.D.; Harald R. Jensen, Ph.D.; Ralph S. Novak, M.A.; Richard Phillips, M.S.; Harry L. Shadle, M.A.; William G. Zmolek, B.S.

Instructors: Bivens, Chryst, Cleary, Clifton, Curry, Dimit, Fessler, Held, Heer, Goldman, Homme, Kehrberg, Kinker, Miller, Pearce, Ramsay, Reiman, Walton

Opportunities for Undergraduate Study

Economics and Sociology offer a wide variety of opportunities for the individual with training in these fields; they are so broad, however, that specialization within each is often desirable. The policy of the department is to adapt the program to the needs of the student. The outline of the subfields in economics is given below. The outline for sociology is given on page 220.

I.*Agricultural Business and Rural Administration. Basic sequence for majors in this field is 231, 232, 233, 407 and 408. Suggested additional courses include 304, 330, 334, 335, 336, 365, 384, 435, 436, 440 and 447.

Minors may be selected in conference with the counsellor.

II.*Consumption Economics. The purpose of this major is to introduce to students, with a background in basic economics, the problems of income use. These problems are approached (1) by individuals and families directly; (2) by business firms and private institutions which offer goods and services to employees or to the public; (3) by governments, through policies of taxation and public expenditure.

This major rests on 211, 212, 213, in which consumption problems are introduced as a part of general theory. If the student's introductory courses have not emphasized consumption economics, 215 should be taken.

Basic courses of this major are 407, 408, 415 or 515, 516, 517.

Students majoring in consumption economics usually elect at least six hours of history, six of psychology and six of sociology.

III.*General Economics. The curriculum in general economics is designed to give the student facility in handling the principal analytical tools in the field and to

*Lists of courses named herein are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counsellors who wish to estimate the amount of basic, non specialized study which may be needed.

acquaint him with the main areas of policy problems. Basic courses are: 211, 212, 213 or 231, 232, 233 or 261, 262, 263; 407, 408; 304, 305, 355, 365, 404, 405, 436 are particlularly recommended.

IV.*Industrial Economics. For students interested in business and industry, having as their goals either private business enterprise or business management positions.

(A) Basic principles, 261, 262, 263.

(B) Courses basic in the area of business management, 305, 365, 366, 384, 385, 386, 443, 444, 463, 464, 468, 474.

(C) Courses of a more specialized and functional nature, 368, 445, 446, 465, 469, 475, 477, 478, 480, 484, 485, 568.

For undergraduate curricula in agricultural business and rural administration, see page 91. For major in consumption economics, general economics, industrial economics and rural and general sociology in the Division of Science, see page 144.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in agricultural economics, industrial economics, consumption economics, and rural sociology; major work for the degree of Doctor of Philosophy in agricultural economics, consumption economics, industrial economics, and rural sociology; and minor work to students taking major work in other departments.

Prerequisite to major graduate work in the department is the completion of undergraduate work in economics, mathematics, statistics, sociology, and other social science and technical subjects, substantially equivalent to that required of undergraduate students majoring in agricultural economics, consumption economics, industrial economics, or rural sociology at this institution.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: Econ. 402, 403, 404, 405, 407, 408, 427, 430, 435, 436, 438, 440, 445, 446, 447, 460, 463, 464, 466, 468, 474, 475, 480, 484, 490; Soc. 404, 405, 406, 409, 419, 460, 464, 485, 486, 487.

Description of Courses

Courses in Economics

Course Primarily for Noncollegiate Students

36. Farm Management. (0-2-3) Cr. 3. W.
Principles. Farm records and their use.

Courses Primarily for Undergraduate Students

110. Technical Lecture. (1-0-0) Required. S.
Field of agricultural economics and rural sociology.

130. Elements of Farm Management. (0-3-2) Cr. 4. F.W.
Not open to students with credit in 330.
For students in farm operation.
Application of economic principles to organization and management of a farm. Budgeting, size of business, choice of enterprise; timing of production, farm labor utilization, farm layouts; leases and farm credit. One all day field trip.

131. Elementary Farm Accounting. (0 1-2) Cr. 2. F.S.
Not open to students with credit in 331.
Principles of farm accounting; training in the keeping of farm records; use of farm records in the analysis of the farm business. Field trip during one laboratory period.

*Lists of courses named herein are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counsellors who wish to estimate the amount of basic, non-specialized study which may be needed.

211*, 212*, 213*. **Principles of Economics.** (0 3 0) Cr. 3 each. F.W.S. each
For home economic students
Economic principles and problems with special reference to consumption economics

215. **Principles of Economics.** (Consumer Aspects.) (0-3 0) Cr. 3. F.W.S
Prerequisite. For transfer students with at least two quarters of economics.
Consumers' choice, consumption and the market, standards of living and measurement of consumption, maximization of satisfaction.

231*, 232*, 233*. **Principles of Economics.** (0 3 0) Cr. 3 each. Yr.
231. F.W.; 232. W.S.; 233 F.S.
For students in agriculture.

261*, 262*, 263*. **Principles of Economics.** (0 3 0) Cr. 3 each.
261. F.W.S.; 262. F.W.S.; 263. W.S.
Introductory survey of the economic forces and institutions of modern society. (261) Production. Value and exchange. (262) Distribution, taxation and fiscal policy, transportation, international trade. (263) Current economic problems.

266. **Elements of Dairy Economics.** (0-2 2) Cr. 3. W.
For students in dairy plant operation. Demand, supply, and distribution of milk and dairy products; the price-making mechanism, marketing methods, grades, values, prices, costs, and government legislation

304. **Money and Banking.** (0-3 0) Cr. 3 F.W
Prerequisite: 262 or equivalent.
Principles of money and credit; the banker customer relationship; contemporary banking institutions and banking practices.

305. **Economics of Industrial Relations.** (0 3 0) Cr. 3. F.W.S.
Prerequisite: 8 credits in Principles of Economics.
Economic aspects of employer and employee relations under present conditions of industry. Matters of public policy such as labor legislation and social insurance.

330. **Farm Management and Organization.** (0-3-2) Cr. 4. F.S.
Prerequisite: 232 or equivalent. Open to students with credit in 130 only by permission of instructor.
Organization and management of a farm with emphasis on use of economic principles. Enterprise selection, size of business, budgeting, leases, layout and farm analysis.

331. **Farm Accounting and Business Analysis.** (0 1-2) Cr. 2. F.W.
Not open to students with credit in 131.
Purpose and methods of keeping farm records, procedures in accounting; income and net worth statements; use of effciency factors; analysis of the farm business. Field trip during one laboratory period.

334. **Land Economics.** (0-3-0) Cr. 3. F.S.
Prerequisite: 233 or equivalent.
Land as a factor of production. Land and population. Theory of rent. Type and intensity of land use. Conservation. Farm tenure. Property rights and social control. Land use and tenure policies.

335. **Agricultural Marketing.** (0 3-0) Cr. 3 W
Prerequisite: 233 or equivalent.
Determining market demand in advance of production. Marketing at the most profitable time and place by alternative methods. Methods of reducing marketing costs.

336. **Agricultural Co-operation.** (0 3 0) Cr. 3 F.
Prerequisite: 233 or equivalent
General survey of co-operative activities, with special reference to agriculture; kinds of co-operatives, methods of organization and operation; principles, legal requirements; economic possibilities and limitations of co-operation.

355. **International Economics.** (0 3-0) Cr. 3. F.
Prerequisite: 232 or equivalent
Principles of international trade and foreign exchange Problems of commercial policy. Foreign trade and American agriculture and industry.

365. **Business Law I.** (0-3 0) Cr. 3. F.W.S.
A. For students in Engineering.
B. For students in Veterinary Medicine.
C. For students in Agriculture.
D. For students in Science and Home Economics.
Fundamental principles of law as applied to business transactions and business relationships. Affords the student opportunity to appreciate our legal system as an agency of social control as well as to observe good business technique and practice.

366. **Business Law II.** (0-3-0) Cr. 3. W
Prerequisite: 365 or consent of instructor
Sales and negotiable documents of title, security relationships; credit instruments.

368. **Business Organization and Public Regulation.** (0-3-0) Cr. 3. S.
Prerequisite: 8 credits in Principles of Economics.
Ownership and management organization; relationship between government and business.

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*Only one of the following economics courses may count for credit toward graduation: 211, 231, and 261; and the same rule applies to 212, 232, and 262; 213, 233, 263.

384. **Accounting I.**
A. For students in Engineering (0 3-0) or (0 2 6) Cr. 3 or 4. F.W.S.
B. For students in Home Economics. (0-2-6) Cr. 4. F.W.
C. For students in Dairy Industry. (0-2-6) Cr. 4 F.W.S.
D. For students in Science and others. (0-2-6) Cr. 4. F.W.S.
Accounting as a tool of management; theory and use of accounts; special journals and control accounts; the accounting cycle; statement preparation; balance sheet; income statements; schedules.

385. **Accounting II.** (0-2-3) Cr.3. W.S.
Prerequisite: 384.
Corporation accounting and statements; surplus analysis; fixed assets; reserves; deferred charges; working capital.

386. **Accounting III.** (0 2-2) Cr. 3. S.
Prerequisite: 385.
Continuation of corporation accounting; fixed liabilities; funds, consolidated statements; statement analysis; budgeting, income taxes.

387. **Machine Methods of Accounting.** (1-0-3) Cr. 3. W.
Prerequisite: 384 (385 or 386 recommended).
Instruction in operation of punched card (Hollerith) sorting and tabulating machines. Basic functions of tabulating equipment and its use for general accounting and statistical control of business operations. Application of I.B.M. and other machines in accounting field.

402. **Marketing Dairy Products.** (D.I. 402) (0-3 0) Cr. 3. W.
Prerequisite: Econ. 335, D.I. 114.
Analysis of the demand for dairy products. Economic problems involved in processing and distributing fluid milk and cream and manufactured dairy products. Costs and price policies, operating efficiency, quality-problems, marketing methods, including cooperation, market news, and market legislation.

403. **Marketing Livestock and Meat.** (A.H. 403) (0-3-0) Cr. 3. S.
Prerequisite: Econ. 335, A.H. 409.
The demand, supply, and distribution of livestock and meat. Analysis of changes in marketing methods; grades, values, prices and costs. One all-day field trip.

404. **Advanced Money and Banking.** (0-3-0) Cr. 3. S
Prerequisite: 304.
Modern monetary theory and problems; credit control; monetary and central bank policies.

405. **Public Finance and Fiscal Policies.** (0 3-0) Cr. 3. F.S.
Prerequisite: 262 or equivalent.
Economic aspects of public expenditures, public borrowing and taxation with special attention to incidence of taxation, debt creation and federal-state-local fiscal interrelationships.

407, 408. **Theoretical Analysis.** (0-3-0) Cr 3 each 407, F.W.; 408, W.S.
407. *Prerequisite:* 263 or equivalent.
408 *Prerequisite:* 407.
Forces determining relative prices and production-volumes of different commodities, including forces determining incomes.

415. **Consumers in the Market.** (H.Mgt. 415) See Home Management.

417. **Commercial Crop Grading and Identification.** (Agron. 417) See Agronomy

418. **Family Finance.** (H.Mgt. 418) See Home Management.

425 **Tax Accounting.** (0 3 0) Cr 3. S
Prerequisite: 384
Principles of income taxation and tax procedures.

430 **Advanced Farm Organization and Management.** (0-2 2) Cr. 3. F.S.
Prerequisite: 232 or equivalent, 330 or 130.
Systems and types of farming, planning organizations for varying soil, market, capital, tenure and conservation situations; short-run and long-run farming adjustments, two all-day field trips into Iowa type-of-farming areas.

431. **Economics of Farm Production and Management.** (0 3-0) Cr. 3. W.
Prerequisite. 233 or equivalent, 130 or 330.
Production location and intensity; combination of land, capital and labor; theory of enterprise combinations; economics of farm size; price and production uncertainty; technological change; timing of production and conservation; efficiency of resource use in the agricultural industry.

432 **Management of Tenant-operated Farms.** (0-1 4) Cr. 3. F.S.
Prerequisite: 130 or 330 and permission of instructor.
Two all-day field trips. Business techniques; application of economic principles to the operation of rented farms; working relationships with farm tenants.

435 **Agricultural Finance.** (0-3-0) Cr. 3. W.
Prerequisite. 233 or equivalent.
Financial requirements of individual farmers and of farm cooperative organizations. Farm credit policy Farm Credit Administration and other lending institutions. Field trips

436. **Business Fluctuations.** (0 3-0) Cr. 3. S.
Prerequisite: 304, 408.
General fluctuations in production, employment, prices, and incomes; their scale and importance; principal explanations suggested; proposed remedies.

437. **Mathematical Analysis.** (Math. 437) F
Prerequisite: Math 101.
Elements of differential and integral calculus, with application to problems in mathematical economics

438. **Economic Statistics.** (Stat. 438) See Statistics.

440. **Appraisal of Farm Real Estate.** (0-2-3) Cr. 3. S
Prerequisite: 233 or equivalent, Agron. 154 or 437.
Land appraisal with emphasis on valuation procedure Relationship of farm prices, taxes, and interest rates to value. Appraisal reports.

443. **Trade Unionism, Theory and Practice.** (0-3 0) Cr. 3. F.
Prerequisite: 305.
History and development of American trade unions. Analysis of contemporary unions in terms of structure, function, and internal relationships. Rights and responsibilities of unionism in modern society.

444. **Management, Theory and Practice.** (0-3-0) Cr. 3. W.S.
Prerequisite: 305.
History of business organization; levels of organization and management structure; lines of authority and functions; formulation of policy; control techniques.

445. **Collective Bargaining.** (3 0 0) Cr. 3. W.
Prerequisite: 305.
Methods, procedures, and problems in collective bargaining. Economics and politics of collective bargaining. Contract negotiation and administration. Special attention to problems of industry-wide bargaining.

446. **Public Control of Labor Relations.** (3-0 0) Cr. 3. S.
Prerequisite: 445.
Analysis of federal and state legislation on collective bargaining and labor relations. Emphasis on essential elements of public policy on labor relations at the federal level, particularly the practical effects of such legislation on the daily conduct of labor-management relations.

447. **Introduction to Agricultural Policy.** (0 3 0) Cr. 3. F.
Prerequisite: 233 or equivalent.
Description of income and resource problems in American agriculture; historical survey of government programs for agriculture; introductory evaluation of recent agricultural programs and policies

460. **Economics of Public Utilities.** (0-3 0) Cr. 3. S.
Prerequisite: 262 or equivalent.
Problems in regulation of public utilities; rural electrification; public development of watersheds

463. **Principles of Transportation.** (0 3 0) Cr. 3. F.
Prerequisite: 262 or equivalent.
Development and analysis of economic problems and public policy pertaining to railroad, motor, and water carriers.

464 **Air Transportation.** (0-3-0) Cr. 3. S
Prerequisite: 262, 463, or consent of instructor.
Economic characteristics and development of commercial transport The role of air carriers in our national transportation system Analysis of economic problems within the air industry and between the industry and other forms of transportation.

465. **Traffic Management.** (3 0 0) Cr. 3. S
Prerequisite: 463.
Fundamentals of industrial transportation as applied to small business and large corporations Freight classification, rate structures and selection of transportation media for freight shipments. Economic implications of transit privileges, routing, warehousing, demurrage and freight claims. Organization and function of industrial traffic departments.

466. **Retailing.** (T.&C. 466) (0-3 0) Cr. 3. S.
Prerequisite: Ec. 212.
Retailing functions in relation to production and consumption; the store and its organization; merchandising policies; store operating and personnel; retailing control For Home Economics students.

468. **Industrial Marketing I.** (0-3-0) Cr. 3. W.S
Prerequisite: 262, 384.
Marketing functions and institutions with emphasis on channels of distribution, costs, price policy, product research, and advertising as applied to the industrial market. Comparison between consumer and industrial markets

469. **Industrial Marketing II.** (0-3 0) Cr. 3. W.
Prerequisite: 468.
Extension of 468 with emphasis on applications of principles to selected cases on price policy, advertising, and sales administration of specific firms or industries. Characteristics and economic importance of the business market.

470. **General Forestry Economics.** (For. 470) See Forestry

474. **Business Finance.** (0-3-0) Cr. 3. F.S.
Prerequisite: 261 or equivalent, 384 recommended.
Principles of financial organization and management. Types of corporate securities, financing and management of new corporations, and reorganizations.

475. **Investments.** (0-3-0) Cr. 3. F.W.
Prerequisite: 262, 384, 474 recommended.
Security prices and yields; essential investment features of various corporate securities—risk, income, control; methods of testing bond and stocks; individual investment programs.

477. **Industrial Risks.** (0-3-0) Cr. 3. W.
Prerequisite: 365, 384.
Risks of modern industry; shifting of industrial risks through the insurance technique. Characteristics of mutual and stock companies. Estimations of insurable costs.

478. **Business Forecasting.** (0 3-0) Cr. 3. S.
Prerequisite: 262, 384, 474.
Methods employed in estimating the probable degree and direction of business change with a view to reducing business risk.

480. **Cost Accounting.** (0-2 4) Cr. 4. F.W.
Prerequisite: 384.
Elements of cost in industrial accounting; preparation of cost reports; job order and process cost accounting methods; introduction to standard costs.

481. **Advanced Cost Accounting.** (0 2 2) Cr. 3. W.
Prerequisite: 480, or consent of instructor.
Problems of joint costs and by-products; standard cost systems; budgetary control; nonmanufacturing cost analysis.

484. **Internal Auditing.** (0 2 2) Cr. 3. S
Prerequisite: 386.
Principle of internal check and its relationship to accounting systems and business procedures; the purpose and objectives of internal auditing; design of internal audit programs; application of auditing principles to specific accounts and activities.

485. **Marketing Management.** (0 3-0) Cr. 3. S.
Prerequisite: 468.
Formulation of marketing policies. Administration of marketing operations. Application of principles to representative problems of selection, training, organizing, and management of marketing personnel. Consideration of techniques in solving the marketing manager's problems through study of illustrative examples.

490. **Forest Finance.** (For. 490) See Forestry.

499. **Special Problems.** Cr. 1 to 5. F.W.S.
Prerequisite: 263 or equivalent, senior classification.
A. Agricultural Economics.
B. Consumption Economics
C. Industrial Economics.

Courses for Advanced Undergraduate and Graduate Students

506. **Economics of Fiscal Policy.** (0-3-0) Cr. 3. W.
Prerequisite: 405, 407. Mr. Wright
Government spending and tax policies in relation to public investment, debt creation, and national income.

507, 508. **Value and Distribution.** (0 3 0) Cr. 3 each. F.W.
Prerequisite: 262 or equivalent Mr. Nordin
Survey of economic methodology, applications of supply and demand analysis to monetary theory; theory of consumption and theory of the firm under perfect competition; introduction to imperfect competition; introduction to micro-dynamics.

509. **Consumption Theory.** (0 3-0) Cr. 3. S.
Prerequisite: 408 or equivalent. Miss Hoyt
Development and objectives; relationship to other types of theory and to practical problems.

510. **Land Use and Conservation.** (0 3 0) Cr. 3. Alt. W. Not offered 1953
Prerequisite: 334 or 407 or permission of instructor. Mr. Timmons
Meaning and importance of conservation. Economic principles applied to conservation. Land resources classification and economic limits of exploitation and development. Appraisal of public controls and group action.

512. **Land Problems and Policies.** (0 3-0) Cr. 3. S.
Prerequisite: 334. Mr. Timmons
Critical appraisal of public policies and programs relating to land problems. Building a national land policy.

514. **Economics of the Household.** (H.Mgt. 514) See Home Management.

515. **Consumer's Marketing.** (H.Mgt. 515) (0-3 0) Cr. 3. W.
Prerequisite: 213 or permission of instructor Miss Douglas
Economic forces affecting markets, with special reference to consumer goods.

516. **Standards of Living.** (H.Mgt. 516) (0-3 0) Cr. 3. W.
Prerequisite: 218. Miss Hoyt
A comparative approach. United States and other countries. Cultural goals, methods of measurement, means of change, with special reference to postwar plans and problems.

517. **Economics of Housing.** (H.Mgt. 517) (0-3 0) Cr. 3. Alt. S. Not offered 1953
Prerequisite: 213 or permission of instructor. Miss Douglas
Needs and standards; construction and land use; expenditures, cost, and valuation; finance, evaluation of proposed housing programs.

520. **Food Economics.** (H Mgt 520) See Home Management.

525. **Presentation of Economic Information.** (T.Jl. 525) See Technical Journalism

528. **Allocation of Income in Agriculture.** (0 3 0) Cr. 3. Alt. W. Offered 1953
Prerequisite: 407. Mr. Heady
Functional and personal distribution of agricultural income; welfare criteria; resource prices and pattern of ownership; problems of poverty; evaluation of agricultural policies affecting income distribution.

534. **Methodology in Agricultural Economics Research.** (0-3 0) Cr. 3. F.
Prerequisite: 283, 384 Mr. Heady
Nature of and limitations in economic analysis; means-end schema; individual and public problems; scientific objectivity; formulation of models and hypotheses; empirical techniques; evaluation of current research procedures.

538. **Elementary Econometric Statistics.** (Stat. 538) See Statistics

540. **World Resources and Industries.** (0 3 0) Cr 3 Alt. W. Not offered 1953
Prerequisite: 233 Mr Kaldor
Economic survey of world's natural resources. Environment and civilization Effect of socio-economic organization and technology on resource utilization. Population distribution in relation to resources as basis of international conflicts

541. **Agriculture in the World Economy.** (0-3-0) Cr. 3. S
Prerequisite: 232 or equivalent. Mr. Kaldor
International trade in farm products; growing industrialization and competition for world markets in farm products; policies of major food importing nations; role of FAO and ITO

544. **Economics of Cooperation.** (0-3 0) Cr 3. W.
Prerequisite: 386. Mr. Robotka
Principles and economic nature of cooperatives; cooperative developments; organizational and operational features; legal aspects; economic role of cooperatives in agriculture and the economy.

547. **Economics of Agricultural Policy.** (0 3-0) Cr. 3. S
Prerequisite: 408. Mr. Kaldor
Application of economic analysis to problems of agricultural policy formulation and appraisal; position of agriculture in the national economy; past and proposed agricultural programs and policies.

548. **Quantitative Agricultural Price Analysis.** (0-3-0) Cr. 3. F
Prerequisite: 407. Mr. Shepherd
Measurement of arc and point elasticity and changes in demand and supply of farm products. Theory of price stabilization and discrimination. Technical analysis of parity and other price and income bases

549 **Agricultural Price and Income Policy.** (0-3 0) Cr. 3. W
Prerequisite: 407. Mr Shepherd
Objectives. Analysis and appraisal of past, present and proposed future programs designed to control agricultural prices by controlling production, market supplies and domestic and foreign demand.

555 **Advanced International Economics.** (0-3 0) Cr. 3 W.
Prerequisite: 355, 407 Mr. Kaldor
Modern international trade theory and problems, exchange-rate theory; appraisal of international monetary fund and international bank

560. **Welfare Economics.** (0 3 0) Cr. 3. S.
Prerequisite: 407. Mr. Nordin
Application of welfare economics to multi-purpose development of a river basin and to problem situations in taxation, international economics, location of industry, public utilities.

568. **Industrial Market Analysis.** (0 3 0) Cr 3 W.
Prerequisite: 468, Stat. 301, 302.
Quantitative determination of market potentials, sales quotas, and sales territories Procedures and techniques emphasized through selected research projects.

574. **Advanced Business Finance.** (0 3 0) Cr. 3. S
Prerequisite: 384 and 474. Mr. Hong
Promotion and expansion of business enterprise. Procedure and planning of the internal financial control of business. Emphasis upon the financial problems of small business enterprise.

575. **Investment Analysis.** (0 2 0) Cr. 2. S.
Prerequisite: 475. Mr. Hong
Practice in analyzing and evaluating securities of twenty or more corporations; cyclical movements of security prices. Methods of investment used by various financial institutions.

590. **Collective Bargaining Problems.** (0 3 0) Cr. 3. S
Prerequisite: 446. Mr. Davey
Advanced analysis of selected problems in the economics and politics of collective bargaining, such as wage-price-profit relationships under collective bargaining, labor, monoply problems, collective bargaining and full employment policy, wage and employment relationships, and adaptation to technological change.

599. **Special Topics.** Cr. 1 to 5. F.W.S.
Prerequisite: Senior or graduate classification.
A. Agricultural Economics. Messrs Arthur, Beneke, Heady, Kaldor, Murray, Robotka, Shepherd, S. H Thompson, Timmons, Tintner
B. Consumption Economics Misses Douglas, Hoyt, Liston
C. Industrial Economics Messrs Davey, Hong, Schrampfer, Thompson
D General Economics. Messrs Hines, Nordin, Tintner, Wright

Courses for Graduate Students

605, 606. **History of Economic Doctrines.** (0-3-0) Cr. 3 each. W.S.
Mr. Wright
Principal figures in development of economic thought; contribution of each period to economics. (605) Greek thought to Ricardo. (606) Ricardo to the twentieth century.

614, 615, 616. **Advanced Theoretical Analysis.** (0-3-0) Cr. 3 each. Yr.
Prerequisite: 408. Messrs. Nordin, Tintner
(614) Critical study of traditional theories of household, firm and competitive market, with attention to contemporary thought. (615) General equilibrium in consumption and production. Modern micro-economic theories, including monetary theories. (616) Uncertainty; relations of "monetary theory" and "value theory"; monetary and debt institutions; monetary policy.

618. **Advanced Family Finance.** (H.Mgt 618) See Home Management.

619 **Methods of Social and Economic Investigation.** (H Mgt. 619) See Home Management

630 **Advanced Land Economics.** (0 3 0) Cr. 3 F.
Prerequisite: 334 or 407 or consent of instructor Mr. Timmons
Supply of and demand for land Principles of land utilization; analysis of rent, value, tax and location theories. Private and public interrelations in land use.

632. **Seminar on Cooperation.** (0-3-0) Cr. 3. S.
Prerequisite 407, or permission of instructor Mr. Robotka

633. **Agricultural Marketing and Price Policy.** (0 3 0) Cr 3 W.
Prerequisite: 407. Mr. Shepherd
Technical analysis of agricultural marketing, distribution, price and income problems.

634. **Land Valuation.** (0 3 0) Cr. 3. S.
Prerequisite: 407. Mr. Murray
Factors determining land value; fluctuation in land prices; critical evaluation of appraisal methods.

635. **Farm Credit Theory.** (0 3 0) Cr 3. W.
Prerequisite: 407, 408 recommended. Mr. Murray
Farm credit policies and methods of extending credit. Organization and operation of lending agencies, private and governmental. Evaluation of alternative agricultural credit systems.

638. **Advanced Econometric Statistics.** (Stat. 638) See Statistics.

641. **Economics of Agricultural Production.** (0-3 0) Cr. 3. W.
Prerequisite: 507. Mr. Heady
Production principles applied to use of land, labor, and capital; static and dynamic firm theory; farm size; resource and product combinations; production location; timing of production and conservation; cost structure; leases and asset control; uncertainty and expectations.

642 **Resource Efficiency and Allocation in Agriculture.** (0 3 0) Cr. 3. S.
Prerequisite: 641. Mr Heady
Efficiency criteria; inter industry productivity comparisons; technological change, resource mobility; firm household interrelationships; returns to firm and society; causes of and means for eliminating production inefficiency.

643. **Economics of Agricultural Production Policies.** (0-3-0) Cr. 3. Alt. S
Not offered 1958
Prerequisite: 507. Mr. Heady
Analysis of policies affecting efficiency of agricultural production; emergency planning, design of policies to promote efficient use of land, labor and capital resources in agriculture

645. **Econometrics.** (Math. 645) (0-3 0) Cr. 3. Alt. S. Not offered 1958
Prerequisite: 408, Math 213, 437 Mr. Tintner
Mathematical formulation and exposition of demand, laws of production, competition, monopoly, taxation, dynamic utility theory, general equilibrium theory, dynamic equilibrium theory.

646. **Time Series.** (Math. 646, Stat. 646) See Statistics.

699. **Research**
A. **Agricultural Economics.** Messrs. Beneke, Heady, Murray, Robotka, Shepherd, Timmons, Tintner, S. H. Thompson
B. **Consumption Economics.** Misses Douglas, Hoyt, Liston
C. **Industrial Economics.** Messrs. Davey, Hong, Lemke, Schrampfer, Thompson
D. **General Economics.** Messrs. Nordin, Tintner, Wright

Courses in Sociology

Opportunities for Undergraduate Study

Sociology is concerned with the nature and workings of group life. Courses are built around selected group functions, institutions, and problems with the objectives of providing (1) information gained through research about group life, (2) insight into the "why" of group behavior, and (3) techniques for studying social situations and problems.

The Major in Sociology. Sociology as a field of concentration points toward a variety of occupational outlets among which are (1) positions in private and public welfare and group work agencies, (2) civil service appointments with government agencies dealing with housing, labor, employment services, farm programs, etc., (3) college and university teaching, research and extension work, and (4) positions with farm organizations, churches and other major rural groups. The facilities of the College provide unusual opportunities for apprenticeship in rural organization, social welfare and rural research and industrial sociology. Qualified students are encouraged to pursue graduate study in sociology or social work, since the more responsible positions require advanced degrees.

Undergraduate majors in this department usually have included the following basic courses in their programs: 200 or 234, 334, 404, 405, 406, 409, 585; Psych. 433, 434 or Stat. 301, 302 or Stat. 401. (234A should be taken after 200 if student plans further work in sociology.) These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counsellors who wish to estimate the amount of basic, non-specialized study which may be needed.

Fields of specialization are represented by the following course offerings:

I. General Sociology: 335, 410, 419, 464, 485, 525, 550, 580, 590, 595.

II. Rural Sociology: 364, 386, 464, 486, 487.

III. Social Welfare and Legislation: 335, 336, 419, 460, 490, 550, 588.

IV. Industrial Sociology: 380, 410, 486, 525, 588.

The Minor in Sociology. Sociology provides a useful supporting minor for those majoring in technical agriculture, vocational education, child development, foods and nutrition, home management, home economics education, history and government, economics, industrial relations and technical journalism.

For opportunities for graduate students see page 213.

Description of Courses

Courses Primarily for Undergraduate Students

200. **Rural Institutions and Organizations.** (0 4 0) Cr. 4. F.W.
For students in Farm Operation.
Factual data on problems of rural groups. Values of rural life. Field trips to farmer meetings, interviews with farm organization officials.

234. **Introduction to Sociology.** (0-3 0) Cr. 3. F.W.S.
A. For agriculture and veterinary students.
B. For engineering and science students.
C. For home economics students.
Interrelations of personality, social organizations and culture; major social processes; practical study of society, using problems and cases.

319. **Marriage and the Family.** (H.Ec. 319) (0-5 0) Cr. 5. F.S.
Prerequisite: Sophomore standing.
An analysis of courtship, marriage, and family relationships. Contributions of biology, home economics, psychology and sociology to the understanding of current marital and familial problems.

334. **Social Problems.** (0-3 0) Cr. 3. F.W.S.
Prerequisite: 234.
Nature and meaning of social problems; incidence and characteristics of selected social problems of major public interest; analysis of proposed solutions.

335. **Criminology.** (0-3-0) Cr. 3. F.
Prerequisite: 234.
Extent and character of crime in rural and urban areas; treatment and care of offenders; programs for prevention. Field trips and interviews with public officials.

336. **Juvenile Delinquency.** (0-3-0) Cr. 3. W.
Prerequisite: 335.
Sociological nature and extent of delinquency; administration of juvenile courts; institutional treatment; probation and parole. Field trips and interviews.

364. **Group Work Techniques and Programs.** (0-2-3) Cr. 3. S.
Prerequisite: 200 or 234.
Group work agencies and programs; planning and conduct of group activities; laboratory and field practice.

380. **Industrial Sociology.** (0-3 0) Cr. 3. S.
Prerequisite: 234.
Human relations in industry; sociology of industrial capitalism; social organization, change, disorganization and industrial relations.

386. **Sociology of Rural Life.** (0-3 0) Cr. 3. F.W.
Prerequisite: 234.
Changing characteristics of rural society; people, technology, institutions, agricultural practices. Social effects and problems.

404, 405. **Sociological Analysis.** (0 3-0) Cr. 3 each. F.W.
404. *Prerequisite:* 234.
405. *Prerequisite:* 404.
Systematic analysis of major concepts, propositions, and theories in sociology.

406. **Methods of Social Research.** (0 3-0) Cr. 3. S.
Prerequisite: 404.
Understanding and use of major non-statistical research methods in the social sciences.

409 **Comparative Cultures; Introduction to Social Anthropology.** (0-3 0) Cr. 3. F.
Prerequisite: 234.
Meaning of culture; cultural growth and cultural diffusion; studies of selected contemporary non-literate societies; comparison with modern industrialized societies; applications of social anthropology to understanding of modern society.

410. **Sociology of City Life.** (0-3-0) Cr. 3. Alt. F. Offered 1952
Prerequisite: 234.
Growth, structure, and functions of the city; centralization and decentralization; effects of the city on group relationships and personality; dominance of the city in modern society.

419. **Dynamics of Family Development.** (0-3-0) Cr 3. F.W.
Prerequisite: 234, C.D. 235.
Natural history of families; how they form, function and grow to maturity. Developmental growth of children and parents in specific stages of the family life cycle.

454. **Field Observation and Practice.** Cr. 1 to 3. F.W.S.
Prerequisite: 9 hours in sociology.
A. Rural organizations and agencies.
B. Industrial plants and related organizations.
C. Welfare and correctional organizations.
Directed analysis and supervised practice under operational conditions.

460. **Fields of Social Work.** (0-3-0) Cr. 3. S.
Prerequisite: 334.
Fields and methods of social work; historical development of three generic fields of social work; field trips to selected institutions.

464. **Community Organization.** (0-3 0) Cr. 3. W.
Prerequisite: 200 or 234.
Coordination, integration and accommodation among groups in rural communities organizing to meet community needs. Field studies.

485. **Sociology of the Family.** (0 3-0) Cr. 3. S.
Prerequisite: 234.
An intermediate course in family relationships.

486. **Leadership and Social Interaction.** (0-3-0) Cr. 3. W.
Prerequisite: 234.
Genesis of leadership; leader-follower roles and leader types in modern society; case studies and critique of contemporary theories.

487. **Farmers' Organizations.** (0 3-0) Cr. 3. F.
Prerequisite: 200 or 234.
Organized efforts of farmers to solve major problems. Development, policies and programs of Grange, Alliance, Farmers' Union, Farm Bureau; Extension Service and other governmental agencies.

490. **Social Case Work.** (0-3-0) Cr. 3. S.
Prerequisite: 460.
Methods and objectives of social work, case reporting and analysis. Supervised home visiting as a basis for study of case needs.

499. **Special Problems.** Cr. 1 to 5. F.W.S.
Prerequisite: 6 credits in sociology.
A. General Sociology.
B Rural Sociology.
C. Social Welfare.
D. Industrial Sociology.

Courses for Advanced Undergraduate and Graduate Students

525. **Race and Cultural Minorities.** (0 3 0) Cr. 3. Alt. S Not offered 1953
Prerequisite: 9 credits in sociology. Mr. Gittler
Meaning of minorities; minority groups as objects of prejudice; analysis of types of prejudice and of proposed solutions in democratic society.

550. **Social Disorganizations.** (0 3 0) Cr. 3. Alt. F. Not offered 1952
Prerequisite: 9 credits in sociology. Mr. Lunden
Disorganization within contemporary society; interrelatedness of social and economic and political problems; appraisal of theories for prevention and treatment.

580. **History of Sociological Theory.** (0 3-0) Cr. 3. Alt. W. Not offered 1953
Prerequisite: 9 credits in sociology. Mr. Gittler
Origin and development of early social thought; early sociological theory; early Greece to the twentieth century.

585. **Population Problems.** (0-3 0) Cr. 3. S.
Prerequisite: 9 credits in sociology. Mr. Wakeley
Composition and characteristics of changing rural-urban population; birth rates, death rates, and mobility; introduction to population theory and policy.

588. **Social Legislation and Policy.** (0 3 0) Cr. 3. S.
Prerequisite: 9 credits in sociology. Mr. Lunden
Sociological contributions to development of social welfare laws; law as crystallization of social policy; status and critique of laws relating to family, dependents, delinquents, social security and welfare agencies.

590. **Social Organization.** (0 3 0) Cr. 3 Alt. W. Not offered 1953
Prerequisite: 9 credits in sociology. Messrs. Lunden, Wakeley
Theories of social organization; group structure and process as frames of reference. Differentiating factors affecting the structure of society; classification of basic social forms.

595 **Contemporary Sociological Theory.** (0-3 0) Cr. 3. Alt. S Offered 1953
Prerequisite: 9 credits in sociology. Mr. Gittler
Analysis of writings of key figures including Max Weber, Simmel, Durkheim, Pareto, Karl Mannheim and Park

599. **Special Topics.** Cr. 1 to 5 F.W.S.
Prerequisite: Senior or graduate classification
A. General Sociology. Messrs. Fulcomer, Gittler
B. Rural Sociology. Messrs. Beal, Wakeley
C. Social Welfare. Mr. Lunden
D. Industrial Sociology. Mr. Gittler

Courses for Graduate Students

660. **Seminar on Sociology.** Cr. 3 each time elected. Messrs. Gittler, Lunden, Wakeley Limited to the following fields: systematic leadership; social change and social planning; migration; research methods in sociology; current rural research; advanced theory; group analysis.

664. **Rural Community—Early Development.** (0-3-0) Cr. 3. Alt. W. Offered 1958. Mr. Wakeley
Characteristic community types in other countries and their part in development of rural society. Background of rural communities in America.

665. **Rural Community—Current Status and Organization.** (0-3-0) Cr. 3. Alt. W. Not offered 1958. Mr. Wakeley
Development of rural-urban community types in United States. Principles governing their organization and functioning.

677. **Seminar on the Family.** (0-3-0) Cr. 3 S.
Prerequisite. 485, C.D. 436, Psych. 515 Mr. Fulcomer

699. **Research.**
Rural Sociology. Messrs. Fulcomer, Gittler, Lunden, Wakeley

Electrical Engineering

MERVIN S. COOVER, E.E., Head of Department

Professors: Warren B. Boast, Ph.D.; Wallace Lewis Cassell, M.S.; Daniel C. Faber, E.E.; G. Ross Henninger, B.S.; George A. Town, D.Engr.

Associate Professor: Robert W. Ahlquist, M.S.

Assistant Professors: Robert L. Doty, B.S.; Walter H. Evans, M.E.E.; John Emil Lagerstrom, M.S.; Glen Arthur Richardson, M.S.; David Dow Robb, M.S.; Raymond A. Veline, B.S.; Lawrence Wayne Von Tersch, M.S.; Benjamin S. Willis, M.S.

Instructors: Davis, Forsman, Gade, Hughes, Klopfenstein, Nilsson, Sandberg, Walter

Opportunities for Undergraduate Study

For undergraduate curriculum in Electrical Engineering leading to the degree of Bachelor of Science, see page 121.

Electrical engineers engage in research, development, design, management, and sales in electrical and radio manufacturing industries, electrical utilities, and communication and radio systems. They serve as electrical engineers and consultants in steel mills, railroads, and industrial plants in general.

The curriculum in electrical engineering has been designed to enable the individual to enter any of these fields, in either power, electronics or radio, according to his incentive, initiative, and talents

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in electrical engineering, and minor work to students taking major work in other departments.

Minor work for the degree of Doctor of Philosophy will usually be selected from mathematics, physics, physical chemistry, and chemical engineering.

Prerequisite to major graduate work in electrical engineering is the completion of undergraduate work substantially equivalent to that required of undergraduate students in electrical engineering at this institution. Any course will be offered in a given quarter provided there is a sufficient demand.

Open to graduate students for minor only: 301, 302, 303, 366, 401, 402, 403, 408, 424, 426, 445, 446, 457, 458, 465, 466, 474, 475, 478, 479, 484, 485.

Description of Courses

Courses Primarily for Undergraduate Students

100. Technical Lecture. (1-0 0) Required. S.
Current electrical engineering thought and practices presented by staff members and visiting lecturers.

211. Fundamentals of Electrical Engineering. (0-3 3) Cr. 4. F.
Prerequisite: Credit or classification in Math. 211.
Basic concepts of electrical engineering.

212. Electric and Magnetic Circuits. (0 3 6) Cr. 5. W
Prerequisite: 211
Introduction to circuit theory

213. Electric and Magnetic Fields. (0 4 6) Cr 6 S
Prerequisite: 212, credit or classification in Math 213, credit or classification in T.&A.M. 274.
Introduction to field theory.

300. Seminar. (1-0-0) Required. S
Prerequisite: Junior classification.

301, 302, 303. Alternating Current Circuits.
301. (0-4-6) Cr. 6. F.
Prerequisite: 213 and credit or classification in Math 316.
302. (0-3-3) Cr. 4. W.
Prerequisite: 301.
303. (0-5-3) Cr. 6. S.
Prerequisite: 302.
Engineering methods for solution of single and polyphase circuits, wave analysis, and wave filters.

338.* Direct Current Circuits and Machines. (0 3 3) Cr. 4. F.
Prerequisite: Phys. 223, Math. 213
Fundamental laws of electric and magnetic circuits General principles of con struction and operation.

339,* 340.* Alternating Current Circuits and Machines. (0 3 3) Cr. 4 each. W.S.
Prerequisite: 338.
Principles of alternating current circuits and machines.

355. Electrical Applications in Buildings. (0-4-3) Cr. 5. F.
Prerequisite: Arch.E. 306.
Circuit arrangements in modern buildings and characteristics of electrical equipment with special consideration to application of electric lighting.

366. Electrical Measurements. (0 0 6) Cr. 2. S.
Prerequisite: 302.
Principles of electrical instrumentation.

400. Senior Inspection Trip. Required. F
Prerequisite: Senior E.E. classification.
Approximately one week spent in industrial centers.

401, 402. Electric Machinery.
401. (0-5-3) Cr. 6. S
Prerequisite: Credit or classification in 303.
402. (0-5-3) Cr. 6. F
Prerequisite: 401.
Principles of electric machinery

403. Electric Machinery. (0 3 3) Cr 4 W
Prerequisite: 402.
Advanced topics in electric machinery.

408. Engineering Analysis. (0 4-0) Cr. 4. S.
Prerequisite: Math. 314, or Math 316 and senior classification.
Principles and methods of analysis from various fields of engineering.

424. Theory of Electrical Networks. (0-3-3) Cr. 4. F.
Prerequisite: 303.
Circuits of distributed constants, lines; Maxwell's equations.

426. Recurrent Electrical Transients. (0-3-3) Cr. 4. W.
Prerequisite: 424, 474.
Response of electrical systems to repeated transients.

434. Electrical Applications.** (0 2 3) Cr 3. W.
Prerequisite: Phys. 223.
Elementary electrical principles and applications

435.† Direct Current Circuits and Machines. (0-3-3) Cr. 4. F.
Prerequisite: Phys. 223, Math. 213.

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*338, 339, 340 are courses designed especially for general, industrial and mechanical engineers.
**434 is for civil and ceramic engineers.
†435 and 437 are for aeronautical, agricultural and chemical engineers.

437.† **Alternating Current Circuits and Machines.** (0 3 3) Cr. 4. W.
Prerequisite: 435.

439. **Applications of Electronics.** (0 2 3) Cr. 3. S.
Prerequisite: 339.
For mechanical engineering students. Applications to mechanical processes; design of equipment using electronic devices.

445, 446. **Electronic Circuits and Instruments.** (Phys. 445, 446) (0-3-3) Cr. 4 each. F.W.
Prerequisite: Phys. 213 or 223. Math. 213. Credit will not be allowed for both 474 and the 445, 446 sequence.
Theory and practice in the use of electronic circuits for scientific measurements.

457, 458. **Radio Engineering.** (0 3-3) Cr. 4 each. W.S.
Prerequisite: 424, 474.
Principles of radio circuits and fields.
(Sequence must be completed to receive 8 credits.)

465. **Transmission Engineering.** (0 4 0) Cr. 4. W.
Prerequisite: 402
Principles of design, construction, and operation of transmission and distribution systems

466. **Power System Engineering.** (0 4 0) Cr. 4. S.
Prerequisite: 403 and 465.
Principles of power system operation, protection and stability.

474. **Electronics.** (Phys. 474) (0-5-3) Cr. 6. W.
Prerequisite: 301, Math. 316, T&A M. 344.
Characteristics and applications of electronic devices, solution of networks containing such elements.

475. **Industrial Electronics.** (0-3-3). Cr. 4. F
Prerequisite: 474 and 401
Continuation of 474, mainly in fields of control and power applications

478. **Television Engineering.** (0-3-3) Cr. 4. S
Prerequisite: 424 and 457.
Consideration of general problems, electronic translation devices, control of electron beams, high-frequency systems.

479. **Medium Frequency Circuits.** (0 3-3) Cr. 4. S
Prerequisite: 303, 474.
For students specializing in power systems. (May not be taken for credit if a student has completed 457 and 458.)

484. **U.H.F. Circuits.** (0-3-3) Cr. 4. S.
Prerequisite: 457, credit or classification in 458.
Circuits and techniques for use at ultra-high frequencies.

485. **Principles of Illumination Engineering.** (0 3-3) Cr. 4. W.
Prerequisite: 303.
Science of illumination from viewpoint of engineering utilization.

498. **Thesis.** Cr. 3 to 5 as arranged. S.
Prerequisite: Senior E.E. classification.
For students especially qualified. Consisting of original investigation and complete report. Subject to the approval of the head of the department, but wide latitude given in choice of topic.

Courses for Advanced Undergraduate and Graduate Students

501. **Circuit Analysis.** (0-5-0) Cr 5. F
Prerequisite: 303, 408, Math 316 Mr. Evans
Analysis of lumped parameter systems including operational methods.

502. **Transformation Theory for Electrical Systems.** (0-5-0) Cr. 5. W.
Prerequisite: 501 or permission of instructor. Mr. Richardson
Electrical engineering applications of conformal transformations and residue theory.

503. **Analysis of Distributed Parameter Circuits.** (0-5 0) Cr. 5. S.
Prerequisite: 501 and either 502 or Math. 612. Mr. Evans
Operational methods.

514. **Electric and Magnetic Materials.** (0-3 0) Cr. 3. F.W.S.
Prerequisite: 501. Mr. Boast
Solid conductors, electrolytes, electric and magnetic fields, polarization and induction, method of images, field mapping, boundary forces.

538. **Transients in Electronic Circuits.** (Phys. 538) (0-3 3) Cr. 4. S.
Prerequisite: 474 and permission of instructor. Mr. Von Tersch
Credit will not be given for both 426 and 538 Electronic circuits of use in research, wave-shaping, pulses, counter circuits

†435 and 437 are for aeronautical, agricultural, and chemical engineers.

590 **Electrical Power Laboratory.** Cr. 3 to 5 F.W.S.
Prerequisite. 402. Mr. Ahlquist
Selected projects in electrical power culminating in comprehensive reports.

595 **Special Topics.** Cr. 2 to 5 each time elected F.W.S
Prerequisite: Permission of instructor Messrs Ahlquist, Boast, Cassell, Coover, Town
Formulation and solution of theoretical or practical problems connected with electrical circuits, apparatus, machines, or systems.

Courses for Graduate Students

605. **Illumination Engineering.** (0 3 0) Cr. 3 F.W.S.
Prerequisite: 485. Mr. Boast
Fundamental concepts, radiation sources, measurement of light, geometry of sources and receivers, lighting design with commercial luminaires

606 **Illumination Engineering.** (0 2 3) Cr 3 F.W.S
Prerequisite: 605 Mr Boast
Illumination from surface and volume sources, transfer of flux between surfaces, advanced lighting design, color.

614. **Electrical Properties of Solid, Liquid, and Gaseous Dielectrics.**
(0 3-0) Cr. 3. F.W.S.
Prerequisite · 514. Mr. Boast
Theory of dielectrics, potential gradient and breakdown potentials, ionization and corona losses.

620. **Seminar.** (0 1 0) Cr. 1. F.W.S.
Mr. Coover

626 **Transmission Engineering.** (0 4 0) Cr 4 F.W.S.
Prerequisite: 465. **Mr. Boast**
Transmission systems.

627. **Distribution Engineering.** (0 3 0) Cr 3 F.W.S.
Prerequisite: 465. Mr. Coover
Substations, distribution systems.

628 **Power System Stability.** (0-3 0) Cr. 3 F.W.S.
Prerequisite: 626. Mr. Boast
Determination of system stability limits.

629. **Power System Protection.** (0 3-0) Cr. 3. F.W.S.
Prerequisite: 626. Mr. Boast
Theory and application of devices for protection of transmission lines; transformers, rotating machines, and other equipment

630. **A-C Network Analyzer.** (0 1 6). Cr 3. F.W.S.
Prerequisite: 626. Mr. Boast
Theory and applications.

643. **Electromagnetic Fields.** (0 4 0) Cr 4 F.W.S.
Prerequisite 424, Math. 316 Mr. Town
General vector fields, Maxwell's equations, wave phenomena

644. **Electromagnetic Radiation.** (0 3 0) Cr. 3. F.W.S.
Prerequisite: 643 or equivalent Mr. Town
Applications of wave theory to guided waves and radiation sources, propagation.

648. **Vacuum Electronics.** (0 3 0) Cr. 3. F.W.S.
Prerequisite: 474. Mr. Town
Emission, space charge, applications in electronic engineering problems.

649 **Gaseous Electronics.** (0 3 0) Cr. 3. F.W.S
Prerequisite: 474. Mr. Town
Fundamentals of gaseous conduction, gaseous discharge devices, applications in industrial electronics.

651. **Electronics Laboratory.** Cr. 1 to 2 each time elected. F.W.S.
Prerequisite: Credit or classification in 648 or 649. Mr. Town
Selected laboratory experiments

660 **Transient Analysis.** (0 2 3) Cr. 3. F.W.S.
Prerequisite: 501, 661 Mr. Ahlquist
Transient effects in operation of electrical machines and systems.

661. **Synchronous Machines.** (0 3 0) Cr. 3. F.W.S.
Prerequisite 402 Mr Coover
Windings, space and time harmonics of magnetomotive force, characteristics of salient pole and cylindrical rotor machines.

662 **Transformers and Induction Machines.** (0 3 0) Cr. 3. F.W.S.
Prerequisite 402 Mr Coover
Polyphase and three winding transformers, induction motors and generators

663. **Single-phase and Special Machines.** (0 3 0) Cr. 3. F.W.S.
Prerequisite · 402. Mr. Coover
Single-phase motors, self synchronous devices

670. **Circuits Laboratory.** Cr. 1 or 2 each time elected. F.W.S.
Prerequisite: 501. Mr. Cassell
Selected projects in electrical circuits.

671. **Four-Terminal Network Theory.** (0 3-0) Cr. 3. F.W.S
Prerequisite: 501. Mr. Cassell
General theory of four-terminal networks, non dissipative uniform ladder structures

672. **Driving-point Impedances.** (0-3-0) Cr. 3. F.W.S
Prerequisite: 501. Mr. Cassell
Foster's reactance theorem, extension to dissipative cases, energy functions and linear network transformations, simulative networks.

673, 674. **Feedback Amplifiers.** (0-3 0) Cr. 3 each. F.W.S.
Prerequisite: 501. Mr. Cassell
Mathematical definition of feedback, stability, physical realizability, design.

675. **Servomechanisms.** (0 3 0) Cr. 3. F.W.S.
Prerequisite: 501. Mr. Cassell
Steady-state theory, stability, performance.

680. **Technical Problems.** Cr. 3 to 5 each time elected. F.W.S
Prerequisite: 501. Messrs. Ahlquist, Boast, Cassell, Coover, Town

690. **Research.** F.W.S
Messrs. Ahlquist, Boast, Cassell, Coover, Town

Engineering

J. F. Downie Smith, Sc.D., Dean of Engineering

Frank Kerekes, C.E., Assistant Dean of Engineering

Lawrence R. Hillyard, M.S., Personnel Officer

Opportunities for Undergraduate Study

For undergraduate curricula offered in the several departments of engineering leading to the degree of Bachelor of Science, see pages 113 to 126

The orientation courses listed are required of all freshman engineering students in order to provide information that will help the student in deciding which curriculum he will follow after the first year.

Opportunities for Graduate Study

Major and minor work for advanced degrees offered in the departments of engineering are indicated in the descriptions of the individual departments. A general course in nuclear engineering is offered under the jurisdiction of the Dean of Engineering.

Description of Courses

Courses Primarily for Undergraduate Students

114, 115. **Orientation.** (1-0 0) **Required.** F.W.
(114) Nature of professional work in engineering. Methods of testing individual's aptitudes for engineering profession. (115) Nature of various branches of engineering and some fundamental considerations in selecting a career.

Courses for Advanced Undergraduate and Graduate Students

504. **Elements of Nuclear Engineering.** (0 2 3) Cr. 3. S
Prerequisite: Phys 436. Mr. Murphy
Use of tracers in engineering Nuclear fuels and wastes Engineering aspects of reactor design and use of nuclear power

Engineering Drawing

JAMES SINCLAIR RISING, M S , Head of Department

Associate Professors Maurice William Almfeldt, B.S ; Alfred S. Gaskell. M.S., Frank Clifford Miller, M.S.

Assistant Professor Charles G. Sanders, M.A.

Instructors Blakemore, Peiffer, Presler, Rogness, Scholten

Engineering drawing is a graphical means of conveying and recording directions for the construction of material objects in such a way that the information is definite, accurate, and readily understood by those who use it.

Engineers do not think of engineering drawing as a profession. Nevertheless, many find it a gateway through which they pass in entering the field of engineering.

In teaching the fundamentals of the subject, emphasis is placed on thinking, visualization, accuracy, neatness, speed in workmanship, development of theoretical knowledge, and the making of complete working drawings which conform to accepted standards.

Description of Courses

Courses Primarily for Undergraduate Students

131. **Drawing and Projection.** (0 0 6) Cr. 2. F.W.S.
Prerequisite: Plane geometry.
Use of the drawing instruments, triangles, architect's and engineer's scales, geometric curves, pencil and ink lettering, orthographic and isometric drawing, pencil and ink tracing, sectioning, auxiliary views.

132. **Theory and Application of Descriptive Geometry.** (0-0-9) Cr. 3. F.W.S.
Prerequisite: 131.
Orthographic drawing principles applied to the solution of advanced space problems involving points, lines, and planes Determination of true distances, true angles, true sizes and shapes, development of surfaces

133. **Technical Sketching and Working Drawings.** (0 0 9) Cr. 3. F.W.S.
Prerequisite: 132 or permission of Department.
Technical sketching, principles of dimensioning, drawing standards, conventional practices, detail and assembly drawings of machines and structures.

235. **Special Drafting Problems.** (0 0 3 to 15) Cr. 1 to 5. F.W.S.
Prerequisite: 133 and permission of instructor.
Symbols, maps, charts, contours, patent drawings. All phases of workmanship emphasized

English and Speech

FRED W. LORCH, Ph.D, Head of Department

Professors: Pearl Hogrefe, Ph.D., Keith Gibson Huntress, Ph.D ; Walter Paul Jones, Ph.D.; Duncan Mallam, Ph D ; Joseph Henry North, Ph.D.; William Randolph Raymond, A B ; Fredrica Van Trice Shattuck, A.B.; Albert Lyell Walker, Ph D.

Associate Professors: David Kincaid Bruner, Ph.D.; Leonard Feinberg, Ph.D.; James E Humphrey, M.A.; Paulus Lange, M.A.; Charles Buell Lipa, Ph.D.; Robert Borgia Orlovich, Ph.D.; Arward Starbuck, A.M.; William Robert Underhill, M.A.

Assistant Professors: Frank E. Brandt, M.S.; Elizabeth Genevieve Fuller, A.M.; Millard R. Kratochvil, A M.; James Allison Lowrie, Ph.D.; Dale McCay, M.A.; Raymond C. Palmer, Ph.D.; John F. Speer, Ph.D ; Edward Palmer Wegener, B.S.

Instructors: Allen, Davis, Day, Fleming, Huffman, Ira Johnson, Theodore Johnson, Rachel Lowrie, McCarthy, Moon, Schulz, Sillars, Stuckey

Opportunities for Undergraduate Study

The instruction offered in English and Speech is designed to give the student a knowledge of the principles underlying effective communication through language and the opportunity for practice in the application of those principles in reading, writing, speaking, and listening.

English 101-102-103, the basic sequence required of freshmen, and Speech 311 provide instruction in fundamental principles, carefully planned to meet the student's personal and professional needs in the oral and written use of language; further skill in communication may be developed in advanced and elective courses in both English and Speech. The study of literature, in addition to developing skill in reading and affording enjoyment, serves to sharpen the student's observation of his own and others' experience and to increase his understanding of himself and the world about him.

Students preparing to teach in the secondary schools, whose work may include the supervision of school or community dramatic productions, debates, or discussions, will find certain courses offered by the department useful as a preparation for such work.

To secure the recommendation of the department as a teacher of English in the secondary schools, the candidate is required to have a quality point average of 2.5 in 15 credits of English beyond English 103, including English 394 and 12 credits in courses chosen by the student with the approval of his classifying officer and of the head of this department. To secure the recommendation of the department as a teacher of speech in the secondary schools, the candidate is required to have a quality point average of 2.5 in 15 credits of speech, including Speech 311 (3 credits) and 12 credits chosen by the student with the approval of his classifying officer and of the head of this department.

The department maintains a writing clinic for the use of sophomores, juniors, seniors, and graduate students who wish to improve their use of written English, and a speech clinic for the use of all students who wish advice on individual speech problems.

The department also offers a limited number of courses in the field of radio broadcasting. These are designed to give the student an understanding of the principles of broadcasting, of radio speech and production.

Description of Courses

Courses in English

Course Primarily for Noncollegiate Students

6. Oral and Written Communication. (0 3 0) Cr. 3 W
Fundamentals of correctness and clarity, business letters and reports, principles and practice in oral expression leading to effective discussion

Courses Primarily for Undergraduate Students

100A, 100B. Principles of Composition. (0 3 0)
100A. Cr. 1; 100 B. Cr. 2. F W
To meet the needs of students with low proficiency in English, offering them an opportunity to meet the requirements of English 101 over a period of two quarters

101, 102, 103 Principles of Composition. (0 3 0) Cr. 3 each. F.W S each
Application of principles governing the use of language in writing, speaking, and reading. (101) Fundamentals of correctness and clarity; adaptation of expression to specific purposes of communication. (102) Technique of informative and persuasive writing; qualities and functions of language. (103) Narrative techniques and descriptive detail as means of communicating fact, opinion, and feeling; function of literature in stimulating observation and evaluation of experience.

205. Propaganda Analysis. Reasoning and Writing. (0-3-0) Cr. 3. F.W S.
Prerequisite: 103, Libr. 106.
Study of the language in which current issues are presented to the public, especially language which may arouse feeling or confuse thought. Application of basic rules of thinking to issues studied; practice in informative and persuasive writing, reading, and discussion.

254. Introduction to American Literature. (0 3 0) Cr. 3. F.W.S.
Prerequisite: 103.
Study of selected works of major American writers, significant for their attitudes toward persistent problems in American life; Lewis, Bellamy, Whitman, Thoreau, Franklin.

256. Contemporary Literature. (0-3 0) Cr. 3. W.S
Prerequisite: 103.
Introduction to contemporary literature through the reading, interpretation, and evaluation of fiction, drama, poetry, and essays by representative American and British writers of the twentieth century.

304. Advanced Composition. (0-3-0) Cr. 3. F.W.S
Prerequisite: 103.
For students who already write with some skill. Descriptive and narrative techniques; emphasis on characterization and the short story. Writing, reading, criticism

305. Advanced Composition. (0-3-0) Cr. 3. F.W.S
Prerequisite: 103.
For students who already write with some skill. Expository types; personal, social, or scientific material. Individualized expression.

306. Advanced Composition. Cr. 3 each time elected. F W.S
Prerequisite: 304 or 305 and permission of instructor.
Individual projects: essays, biography, autobiography, poems, stories, novels.

344. Readings in Biography. (0-3-0) Cr. 3. S
Prerequisite: 103.
Selections from biography and autobiography of world's great creative workers in science, engineering, agriculture, the arts, government. Other eminent contributors to civilization. Special attention to lives of scientists and to procedures of science Impact of great men upon their own and later times.

354. World Literature. (0 3 0) Cr. 3. S
Prerequisite: 103.
Masterpieces of Greek, Roman, Italian, German, and Russian literature.

356. Old Testament. (Rel.Ed. 356) (0-3-0) Cr. 3. W.
Prerequisite: 103.
Literature of Old Testament, including narrative, poetry, wisdom literature and prophetic literature.

364. American Masterpieces. (0-3-0) Cr. 3. F.W.S
Prerequisite: 103.
Critical study of selected American masterpieces, with special attention to their literary values and to their significance as expressions of fundamental attitudes toward the individual and society

374. British Masterpieces. (0 3 0) Cr. 3 Alt S Offered 1953
Prerequisite: 103.
Significant works of great English writers prior to 1775.

375. Romantic Literature. (0 3-0) Cr. 3. Alt S Not offered 1953
Prerequisite: 103.
Reading and interpretation of representative works of Wordsworth, Coleridge, Bryon, Shelley and Keats.

376. **Victorian Literature.** (0 3-0) Cr. 3. W.
Prerequisite: 103.
Major Victorian poets and prose writers: Tennyson, Browning, Arnold, Carlyle, Ruskin, Newman, and Huxley.

384. **Modern Fiction.** (0-3-0) Cr. 3. S.
Prerequisite: 103.
Materials, techniques, and philosophies of modern fiction. Development of personal standards for reading and evaluating fiction.

388. **Modern Poetry.** (0 3 0) Cr. 3. F
Prerequisite: 103.
Reading of representative work of significant American and British poets of the twentieth century; interpretation of the poems as the communication of personal and social values.

394. **The Teaching of English.** (0 3 0) Cr. 3. S
Prerequisite: Quality point average of 2.5 in 12 credits of English in courses above 103 selected by the student with the approval of the head of the department.

404. **Business Correspondence.** (0-2-0) Cr. 2. W.S.
Prerequisite: 103, senior college classification.
Principles which govern the writing of business letters. Types of business letters.

414. **Writing of Scientific Papers.** (0 3-0) Cr. 3. F.W.S
Prerequisite: 103.
For juniors and seniors in co-operating technical departments. Principles of technical exposition; practice in composition of scientific reports of various types.

464. **Shakespeare.** (0-3 0) Cr. 3. F.S.
Prerequisite: 103.
Representative comedies, historical plays, and tragedies; emphasis upon understanding of human character.

466. **Drama.** (0 3-0) Cr. 3 Alt. W. Offered 1953
Prerequisite: 103.
Study of plays representing the development of drama from classical to modern times as the presentation in dramatic form of human character in action.

467. **Modern Drama.** (0-3-0) Cr 3. Alt. W. Not offered 1953
Prerequisite: 103.
Materials, techniques, and philosophies of modern drama, reading, discussion, and criticism of representative modern plays.

484. **The Literature of Family Life.** ((0-3-0) Cr. 3. F.W.
Prerequisite: Senior college classification or approval of head of the department.
The relations of the individual to his family and to the community as reflected in selected works of fiction, drama, biography, and other types of literature.

494. **Special Problems.** Cr. 2 to 5. F.W.S.
Prerequisite: Six credits in English beyond Engl. 103 or senior college classification in addition to approval of department head.
Designed to meet the needs of (1) students who seek work in literature or language in areas other than those in which courses are offered; and (2) honor students who desire an opportunity to integrate a study of literature or language with special problems in major fields.

Courses in Speech

Courses Primarily for Undergraduate Students

301. **Principles of Broadcasting.** (0-3-0) Cr. 3 F.S.
Prerequisite: Engl. 103

302. **Radio Speech.** (0-3 0) Cr. 3. F.W.
Prerequisite: Speech 301 or permission of instructor.

303. **Radio Production.** (0-3-0) Cr. 3. S
Prerequisite: Speech 301.
Techniques of producing radio programs.

307. **Speech Improvement.** (0-3-0) Cr. 3. F.W.S
Basic principles underlying development of acceptable habits of speech; voice, enunciation, pronunciation, poise; practice in speaking adapted to needs of individual students.

309 **Oral Interpretation.** (0-3-0) Cr. 3. F.S.
Principles of oral interpretation; practice in analysis and reading aloud of literary selections.

311. **Speech-Making.** (0-3 0) Cr. 3. F.W.S.
Prerequisite: Engl. 103.
Fundamental principles of public speaking; audience analysis; interest and attention; selection and organization of speech material; delivery. Practice in preparation and delivery of extemporaneous speeches.

312. **Public Address.** (0 3 0) Cr 3 F.W.S.
Prerequisite: 311.
Methods of application of fundamental principles of public speaking to composition and delivery of common types of public address; practice in preparation and delivery of various types of speeches.

320. **Dramatics.** Cr. 1 to 3 each time elected, with a maximum of 6 credits. F.W.S
Prerequisite: Engl. 103 and permission of instructor.
Rehearsal and public performance of plays

324. **Dramatic Production.** (0 3 0) Cr. 3. S.
Prerequisite: Engl. 103
Principles of play production, choosing the play, casting, rehearsing, acting, staging, lighting, and make-up.

332. **Debate.** Cr. 1 to 3 each time elected, with maximum total of 6 credits. F.W.S.
Prerequisite: Engl. 103 and permission of instructor.
Techniques of debate, platform and radio discussion.

334. **Persuasion.** (0-3 0) Cr. 3. F.W.S
Prerequisite: 311.
Principles and methods of persuasive speaking; discovery and use of evidence; proof; refutation; appeals; organization; delivery; practice in preparation and delivery of persuasive speeches upon topics of current interest.

336. **Group Discussion.** (0-3 0) Cr. 3. S.
Prerequisite: 311.
Principles and types of discussion; practice in all types of group discussion, including parliamentary procedures, instruction in the handling of motions, conduct of parliamentary groups.

361, 362, 363. **Play Selection.** (0-3 0) Cr. 3 each. Yr.
Prerequisite: For each course, classification in senior college.
(361) Analysis and interpretation of standard modern plays in terms of stage presentation. (362) Study of differing interpretations of representative current American and British plays as determined by differences in acting and staging. (363) Study of plays suitable for production by school and community groups.

Farm Crops

For description of courses, see Department of Agronomy, courses in Farm Crops, page 168

Food Technology

Administrative Committee GEORGE M BROWNING, Ph D, Chairman

ROBERT G. TISCHER, Ph.D, Vice-Chairman

John C. Ayres, Ph D.; Emerson W. Bird, Ph D ; Ralph M Hixon, Ph D ; Joseph Kastelic, Ph.D ; Belle Lowe, M S.

Opportunities for Undergraduate Study

The field of Food Technology is concerned with technological application of the sciences and engineering arts to the manufacture, transportation, storage, distribution and utilization of food products. It is based on the fundamentals of biology, chemistry, microbiology and physics, any of which sciences find expression through an engineering operation. Many opportunities exist for persons trained in Food Technology, these are to be found in the following functional branches of this field

1. Processing and manufacture of food products.
2. Quality control in the procurement, processing, manufacture, distribution and utilization of food products.
3. Economics of food processing, distribution, and consumption.
4. Legal specifications relative to composition, quality and safety of food products.
5. Consumer utilization of food products
6. Research and development in food products and their by-products.

Because of the complexity of the field of Food Technology, undergraduate training is confined largely to the acquisition of the necessary background in the physical and biological sciences, although some work specifically applied to food technology is included. In addition, three months of practical work in the food industry is required. It is strongly recommended that at least one year of graduate work (leading to the Master's degree) be taken before embarking on a career in Food Technology.

For undergraduate curriculum in science, major in Food Technology, leading to the degree of Bachelor of Science, see page 144.

Opportunities for Graduate Study

Major work is offered for the degrees of Master of Science and Doctor of Philosophy in food technology.

Students majoring in food technology will choose a major professor from the graduate faculty membership of the departments cooperating in the graduate food technology program. Students will develop their programs of study under the guidance of committees nominated by the Administrative Committee, and appointed by the Dean of the Graduate College.

Prerequisite to major graduate work is the satisfactory completion of a suitable undergraduate curriculum, including courses in mathematics through differential and integral calculus; a year of physics based upon a year of college mathematics; chemistry (the equivalent of about eight quarters of chemistry, usually including inorganic, qualitative, quantitative and organic); one year in biology [botany and (or) zoology] and one course in general bacteriology.

Ordinarily the candidate's graduate committee will require, in addition to training in statistics and chemical engineering, the following courses for the doctorate: Bacteriology 535, 536 and Chemistry 323, 474, 531, 532.

The following courses are open for major graduate credit to graduate students in food technology:

Animal Husbandry 535 and 690E.

Bacteriology 501, 531, 534, 535, 536, 537, 546, 547, 561, 562, 563, 575, 631, 632, 633, 690F, 690I.

Botany 641, 642, 643.

Chemical Engineering 531, 532, 533, 561, 564, 565, 574, 585, 599, 600, 615, 618, 651, 652, 653, 661, 662, 663.

Chemistry 518, 519, 521, 522, 523, 525, 526, 531, 532, 533, 535, 545, 546, 547, 575, 576, 577, 584, 585, 586, 631, 655, 671, 672, 674, 695.

Dairy Industry 508, 558, 559, 643, 655, 656, 659, 660, 690.

Economics 515, 520, 614, 615, 616, 632, 633, 642, 699.

Foods and Nutrition 511, 512, 513, 600, 601, 606, 607, 608, 609, 614B, 615, 616, 620, 624, 630.

Horticulture 534, 535, 564, 600D.

Mechanical Engineering 640, 655

Poultry Husbandry 602, 690D.

Statistics 504, 511, 512, 522, 535, 541, 542, 543.

Foods and Nutrition

ERCEL SHERMAN EPPRIGHT, Ph.D., Head of Department

Professors: Gladys June Everson, Ph.D.; Belle Lowe, M.S.; Pearl Pauline Swanson, Ph.D.

Associate Professors: Mary Agnes Frances Carlin, Ph.D.; Charlotte Elizabeth Roderuck, Ph.D.

Assistant Professors: Jewel Graham, M.S.; Frances M Hettler, M.S.; Madge Miller, M.S.; Nelle Elizabeth Thompson, M.A.

Instructors: Barte, Christensen, Hewitt, Krecklow, Loomis. Porterfield, Roberts, Sandberg, Thomas

Opportunities for Undergraduate Study

For undergraduate curricula in foods and nutrition leading to the degree of Bachelor of Science, see page 132.

The department offers a curriculum in foods and nutrition designed to acquaint the student with the principles underlying the selection, preparation, and use of foods for maintaining the nutrition of the individual. Opportunity is given for the election of one of four majors; dietetics, nutrition in public health and social welfare, experimental cookery, and foods and nutrition and related science See pages 132, 133, 134 and 136

The major in dietetics is designed to prepare for service as a dietitian in hospitals, colleges, or similar institutions. Following graduation, a postgraduate course in a hospital or institution approved by the American Dietetic Association is recommended. Upon completion of this course, the student is eligible to membership in the American Dietetic Association. The major in nutrition in public health and social welfare is designed to prepare for work as a nutrition specialist or consultant in social work, public health, extension service, or industrial organization. Both the majors in dietetics and in nutrition provide the fundamental training for entrance into graduate study in nutrition. The major in experimental cookery is planned for the student who desires to prepare for employment in testing kitchens, in food demonstration work, and in the promotional branches of a wide variety of food industries. The major in Foods and Nutrition and related science is designed to prepare for graduate study, research, or appointment as laboratory technician in foods and nutrition in allied fields

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in foods and in nutrition; major work for the degree of Doctor of Philosophy in foods and in nutrition; and minor work to students taking major work in other departments.

Prerequisite to major graduate work in foods or nutrition is the completion of at least 50 quarter credits of undergraduate work which should include courses in food preparation, dietetics, nutrition, physics, human physiology, bacteriology, and chemistry (general, organic, physiological, and quantitative methods). Students desiring to take major work in foods should present in addition, if possible, undergraduate credits in experimental cookery. In addition to the courses specified a general background in home economics is recommended, although students well trained in the fundamental sciences may qualify for graduate study in foods and nutrition.

Students taking major work either in foods or in nutrition for the degree of Doctor of Philosophy may select minors from such fields as chemistry, bacteriology, food technology, physiology, microscopic anatomy, economics, or statistics. A minor may also be selected from other fields of Home Economics.

Open to students for minor only: 305, 404, 405

Description of Courses

Courses Primarily for Undergraduate Students

107. **Introduction to Foods and Nutrition.** (3-0-0) Cr. 3. F.W.S.
The selection and use of food in relation to the health and well being of the individual and to the needs of society.

204, 205. **Food Preparation.** (1 1-6) Cr. 4 each F.W.S. each
204. *Prerequisite:* 107, Chem. 106.
205. *Prerequisite:* 204.
Composition, selection, and preparation of standard food products.

303. **Meal Planning.** (0 0 9) Cr. 3. F.W.S
Prerequisite: 205 or 304.
Choice, purchase, preparation and service of foods with a consideration of nutritional needs of family groups, food habits, and social customs. Reservations must be made in advance with Head of the Department.

304. **Advanced Food Preparation.** (1-0 6) Cr. 3 F.W.S.
Prerequisite: 205.
Factors affecting preparation of standard food products.

305. **Nutrition and Dietetics.** (3-0-3) Cr. 4. F.W.S.
Prerequisite: 303, Bact. 304A or B or Bact. 200, Chem. 274 or 275, Zool. 155.
Principles of normal nutrition and practice in planning, adjusting and preparing dietaries for specific individuals.

307. **Food Preparation Problems.** (1 0-6) Cr. 3 S.
Prerequisite: 205 or 304.
Factors affecting standard cookery procedures.

404. **Seminar in Nutrition and Dietetics.** (0-2-0) Cr. 2. F.W.S.
Prerequisite: 305.

405. **Nutrition of the Child in the Family.** (3-0-3) Cr. 4. S.
Prerequisite: 303, Chem. 274, C.D. 235 and 300.
Nutritional needs of family members and plans for meeting them; problems relating to child feeding; the contributions of nutrition to the total health and well-being of the child and of the family.

406. **Fundamentals of Food Selection and Preparation.** (0-0-3) Cr. 1. S.
Principles of cookery, meal planning, and preparation adapted to forestry, engineering, scout camps, and organized houses. Open to men.

408. **Food Preparation.** (1-0-6) Cr. 3. S.
Prerequisite: Chem. 474.
Factors affecting preparation of food. For food technology majors.

Courses for Advanced Undergraduate and Graduate Students

504. **Diet Therapy.** (3 0 0) Cr. 3. F.W.
Prerequisite: 305. Miss Everson
Physiological basis for the use of special diets.

506. **Nutrition of Children.** (2-0-3) Cr. 3. F.W.S.
Prerequisite: 305. Miss Krecklow
Indices of nutrition and application of principles of nutrition to feeding infants and older children.

507. **Special Topics.** Credit as arranged. F.W.S.
Prerequisite: 305 Mrs. Eppright, Misses Everson, Lowe, Roderuck, Swanson
A. Nutrition.
B. Foods.

[1]511, 512, 513. **Experimental Cookery.** (1 0-6) Cr. 3 each.
511. *Prerequisite:* 205, Chem. 265, or Chem. 264 and H.Eq. 405, or Chem. 264 and Phys. 212. F.
Misses Carlin, Lowe, Hettler
512. *Prerequisite:* 511. W. Miss Lowe
513. *Prerequisite:* 512. S. Miss Lowe
(511) Egg cookery, emulsions, jelly, batters, and doughs. (512) Fats and oils, meats, special problems. (513) Preparation and freezing of foods. Individual problems.

[1]Reservations for F.&N. 511 must be made in advance with head of department

514. **Nutrition and Public Welfare.** (2 0-3) Cr 3. Alt. S. Not offered 1953
Mrs. Eppright
Prerequisite: 305.
Nutritional problems and food habits of population groups; dietary planning for special groups; methods of making dietary studies and judging apparent nutritional status; local, state, national, international public health programs in nutrition.

515. **Introduction to Nutrition Research.** (0 0 9) Cr. 3. W.
Prerequisite 305, Chem 474, Bact 304A or B
Misses Everson, Myers, Roderuck, Swanson
Introduction to methods used in nutrition research with application to selected problems.

518. **Methods of Teaching Hospital Dietetics.** (3-0 0) Cr. 3. W.S.
Prerequisite: 504.
Objectives, techniques, and organization of subject matter for teaching medical and dietetic interns, student nurses, and patients.

Courses for Graduate Students

600. **Energy Metabolism.** (2 0 0) Cr. 2. S.
Prerequisite: 305. Mrs. Eppright
Theories of energy metabolism; methods of caloric measurement.

601. **Principles of Normal Nutrition.** (3-0-0) Cr. 3. F.
This course or its equivalent is required of all graduate students in department.
Miss Everson

606. **Research Methods in Nutrition.** (1-0-9) Cr. 4. F.
Prerequisite: 305. Misses Roderuck, Swanson
Adaptation of chemical techniques to analysis of food, tissues, and metabolic products.

607. **Research Methods in Nutrition.** (1-0-9) Cr. 4. W.
Prerequisite 606 Miss Swanson
The animal-feeding experiment as a technique in nutrition research.

608. **Research Methods in Nutrition.** (1-0 6) Cr. 3. W.
Prerequisite: 305. Misses Everson, Roderuck
Quantitative estimation of vitamins and other nutrients in foods and biological materials, evaluation of new methods in nutrition research.

609. **Seminar.** Credit as arranged.
Mrs Eppright, Misses Everson, Lowe, Roderuck, Swanson

614. **Research.**
A. Nutrition Mrs Eppright, Misses Everson, Lowe, Roderuck, Swanson
B. Foods. Miss Lowe

615. **Functions of Nutrients.** (3 0 0) One unit offered each quarter. Cr. 3.
Prerequisite: Chem 481 Mrs Eppright, Misses Everson, Roderuck, Swanson
Current information relating to the role of the various nutrients in physiological process.
A. Proteins.
B. Vitamins.
C. Minerals and lipids.

616. **Problems in Nutrition.** (3-0 0) Each unit offered alternate years. Cr. 3.
Prerequisite: Permission of instructor.
Mrs Eppright, Misses Everson, Roderuck, Swanson
Critical evaluation of problems encountered in application of nutritional knowledge.
A. Evaluation of Nutritional Status
B. Vitamin B complex.
C. Nutrition and Human Welfare
D. Implications of Departmental Research

620. **Fats in Relation to Food Preparation.** (2 0 0 or 3) Cr 2 or 3.
Prerequisite: 512. Alt. F. Offered 1952. Miss Lowe

624. **Proteins in Relation to Food Preparation.** (2 0 3) Cr. 3.
Prerequisite: 512 Alt. S. Not offered 1953. Miss Lowe

630 **Research Methods in Nutrition.** (1-0 6) Cr. 3. As arranged
Prerequisite: 607. Misses Everson, Swanson
Techniques of metabolism studies, human and animal

Forestry

GEORGE BERNHARDT HARTMAN, M.S., Head of Department

Professors: Dwight W. Bensend, Ph.D.; Leonard F. Kellogg, M.F.; Andrew Logan McComb, Ph.D.; Gilmour Byers MacDonald, M.F., D.Agr.

Associate Professor: Julius Ansgar Larsen, Ph.D.

Assistant Professors: Richard B. Campbell, B S ; Russell E Getty, B S.

Instructor. Thomson

Opportunities for Undergraduate Study

For undergraduate curriculum in forestry leading to the degree of Bachelor of Science, see page 102.

The department offers four-year and five-year curricula designed to fit the student for professional forestry work.

A ten-week summer camp between the freshman and sophomore years is required of all students. Fees of $115 for camp board and $35 for incidentals are required of students enrolling in the camp program. This is in addition to the regular summer session registration fee of $50. An additional tuition charge of $59 is required by out-of-state students. A six-week camp for advanced work following the junior year is optional. The special camp fees for this six-week camp are $71 for board and $21 for incidentals in addition to the regular summer session fee of $30 Fees for board are approximate.

The four-year curriculum is designed to prepare students for administrative or research work with the United States Forest Service and other federal agencies; for similar positions with various state forestry departments; for the lumber, paper, plywood, and other forest industries; for wholesale and retail lumber marketing; for grazing and wildlife management work; for teaching and extension work; and for farm forestry work.

The five-year curriculum offers opportunity for additional specialization for major work in the five fields of conservation, forest utilization and marketing, range management, wildlife management, and farm forestry.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in forest management, forest utilization and marketing, and forest range management; and minor work to students taking major work in other departments.

Students desiring to major in this department should present forestry credits substantially equivalent to those required of undergraduate students at this institution.

Minor work is usually recommended in botany, particularly plant pathology, agrostology, ecology, dendrology, or plant physiology; entomology; chemistry; soils; landscape architecture; economics; or zoology.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: 301, 302, 303, 388, 390, 392, 400, 443, 470, 490, 491, 492, 493, 497, 498.

Description of Courses

Courses Primarily for Undergraduate Students

101, 102. **General Forestry.** Cr. 3 each. F.W
General survey of field forestry.

103 **General Forestry.** S.
A. (0-0-6) Cr. 2. For students with college credit in lettering and drawing.
B. (0-0 9) Cr. 3.
General survey of field forestry. Elementary field procedures, use of instruments, elements of mapping.

110 **Forestry Seminar.** (1 0 0) Required. S.
Discussion of current topics relating to forestry.

120. **Farm Timber Production.** (2 0 3) Cr 3 W.S.
Managing farm woodlands for profit Improvement cuttings; protecting the stand, measuring the crop; how and when to harvest; using home-grown lumber on the farm. Field demonstrations.

206. **Forest Planting.** (2 0 6) Cr. 4. S.
Collection and treatment of tree seeds Forest nursery practice. Field planting.

211, 212, 213. **Forestry Seminar.** (1 0 0) Required Yr.
Current forestry topics.

214. **Silviculture.** (0-0 9) Cr. 3 Summer Camp
Field studies of forest types and stands, forest ecology, improvement of young stands; forest regeneration.

224. **Logging.** (3 0 0) Cr. 3. F.
Study of logging practices in principal forest regions; transportation of logs, methods employed, and equipment used.

225. **Lumber Manufacture.** (3-0-0) Cr. 3. W.
Lumber manufacturing plants; equipment used; mill products; air seasoning and kiln drying lumber.

234. **Wood Utilization.** (0 0 9) Cr. 3. Summer Camp
Forest industries: logging and milling operations; pulp and paper plants and other wood-using activities.

241. **Forest Mensuration.** (2-0 6) Cr. 4 W.
The measurement of logs and forest products Tree form. Volume table construction. Ground methods of timber estimating

242. **Forest Mensuration.** (2-0-3) Cr. 3. S.
Prerequisite: 241.
Elementary studies in growth of trees and stands.

244. **Forest Mensuration.** (0 0 12) Cr. 4. Summer Camp
Field studies and practice in scaling logs and estimating timber stands. Collecting data and preparing forest maps.

250. **National Forest Operations.** (0 0 15) Cr. 5. Summer Camp
Study of various field activities on national forests.

301, 302, 303. **Silviculture.** (3-0 0) Cr. 3 each. F.W.S.
301. *Prerequisite:* Bot. 424, credit or classification in Bot. 205
302. *Prerequisite:* 301.
303. *Prerequisite:* 302.
(301) Factors determining classifications of forest stands, types and formations; forest influences. (302) Scientific systems of harvesting forest trees, and their application to forests of various ages and composition; improvement of immature forests. (303) Practice of silviculture in United States and abroad.

311, 312, 313. **Forestry Seminar.** (1-0 0) Required. Yr.
Discussion of current forestry topics.

320. **Farm Forestry.** (2-0-3) Cr. 3. F.
Forestry in present day agriculture Federal and state legislation involved. Policy and technique in forest protection and woodlot management; reforestation, shelterbelt planting, marketing forest crops, and forestry extension program. Not open to forestry students.

321. **Farm Forestry.** (2-0 3) Cr 3 S.
Prerequisite: 241, 301.
Application of specific forestry techniques to the problems of the woodlot with special emphasis on woodlot grazing, woodlot management, measurement and marketing of woodlot products, extension forestry and the promotion of forestry for farmers.

385. **Timber Preservation.** (3 0 0) Cr. 3. S
Agencies causing wood destruction Methods of protecting wood products from decay, insects, fire. Detailed study of wood preserving plants

388. **Wood Technology.** (1 0 9) Cr 4 W
Prerequisite: Bot. 101.
Structural and physical properties of commercial woods; identification and chief uses

390. **Forest Protection.** (3 0-0) Cr. 3. S.
Prerequisite: Physics 204.
Character and extent of damage to forests by fire, weather, animals and disease. Forest fire prevention, pre-suppression and suppression, fire control equipment, fire damage appraisals and forest fire insurance.

392. **Forest Policy and Administration.** (4 0 0) Cr. 4. S
Prerequisite: 390
State and national forest laws and policies. Personnel, organization, financing and supervision of federal, state and local public and private forest enterprises; forest improvements, grazing, timber sales and special uses.

400. **Forest Conservation.** (3 0 0) Cr. 3 W.
Prerequisite: Zool. 105, 107, or Bot. 101.
Not open to forestry students. Development of forest conservation, national, state, and private. Forests in relation to human needs. Forestry as related to other conservation work.

411, 412, 413. **Forestry Seminar.** (1-0-0) Required Yr.
Current reports on forestry and allied topics.

438. **Lumber Markets.** (3 0 0) Cr 3. W
Economics of the timber industry. Wholesale and retailing. Exports and imports of lumber and other forest products; lumbermen's associations; prices; freight rates

440 **Special Problems.** Cr. 2 to 6 F.W.S.
Prerequisite: Senior college classification and quality point average of 2.5 or more for preceding two quarters.
Original investigations in advanced technical work.

443. **Forest Mensuration.** (2-0 3) Cr. 3. F.
Prerequisite: 241, 242.
Sampling patterns for timber estimating and the reliability of results. Yield table construction. The problem of growth determination in forest stands.

445. **Forest Photogrammetry.** (2 0 9) Cr. 5. F.
Prerequisite: 242, 302
Use of aerial photographs in forest mapping Measurements of trees and timber stands on vertical photographs for the purpose of estimating timber volume. Preparation of visibility, type and topographic maps and relief models.

470. **General Forestry Economics.** (Ec. 470) (3-0-0) Cr. 3. W
Prerequisite: Ec. 261 or equivalent.
Elementary application of economics to forestry. Production, distribution, and consumption of forest products. Production management of forests.

487. **Forest Products.** (5 0 0) Cr. 5. W.
Production and uses of forest products other than lumber.

488. **Commercial Woods.** (2 0 3) Cr. 3 W
For engineering students Identification and uses of principal woods. Properties, defects, seasoning, and preservation of wood

490. **Forest Finance.** (Ec. 490) (4 0 3) Cr. 5 F.
Prerequisite: Ec. 261.
Appraisal of forest land and stumpage. Determination of profits in forest enterprises. Appraisal of damages to forest property.

491. **Forest Range Management.** (3 0-0) Cr 3. F.
Prerequisite: Bot. 424.
History of national forest range Range types and forage. Poisonous plant control. Principles of range management and grazing policies on national forests. Relationship of grazing to other forest uses.

492. **Forest Range Administration.** (3 0 0) Cr. 3. W.
Prerequisite: 491.
Management and administration of range on national and state forests and other public areas.

493. **Forest Range Management Plans.** (2 0 3) Cr. 3. S.
Prerequisite: 492.
Range surveys and preparation of detailed range management plans for different national forest regions and public range lands.

497 **Forest Management.** (3 0-0) Cr. 3. W.
Prerequisite: 302, 490.
Organization of the forest for management. Study of the factors used in forest regulation.

498. **Forest Management.** (3-0-0) Cr. 3. S.
Prerequisite: 497.
Regulation of the forest for sustained yield. Forest management plans. Present practice of forestry.

Courses for Advanced Undergraduate and Graduate Students

502. Advanced Silvics. (3 0-0) Cr. 3. F.
Mr. McComb
Prerequisite: 303.
The tree and the site as factors in forest production; differentiation, multiplication and use of superior individuals, varieties and races in forestry; site factors and site evaluation in relation to choice of species and maintenance of productivity.

507. Forest Influences. (3 0 0) Cr. 3. W.
Mr. McComb
Prerequisite Agron 154, Bot 424
Relation of forests to climate, soil water, run-off, streamflow, floods and soil erosion.

530. Advanced Forest Industries. Cr. 3 to 9. Summer Camp
Messrs. Bensend, Hartman
Prerequisite: 224, 225.
Detailed study of operation and management of private forest industries.

540. Special Topics. Cr. 3. F.W.S.
Messrs. Bensend, Hartman, Kellogg, McComb, MacDonald
Not open to forestry majors. Special work in the fields of silviculture, forest management, forest utilization and forest administration and policy designed to round out the training of students working toward a minor in forestry.

587 Advanced Forest Products. (3 0 0) Cr. 3. S.
Mr. Bensend
Prerequisite: 487.
Major forest industries including pulp and paper, veneer and plywood, and naval stores.

588. Mechanical and Physical Properties of Wood. (2 0 3) Cr 3. S
Mr. Bensend
Prerequisite: 388.
Mechanical properties of wood and the structural and physical characteristics affecting these properties.

590 Advanced Forest Administration. Cr. 3 to 9. Summer Camp
Mr. Kellogg
Prerequisite: 250.
Management and administration of specific national, state, or private forest lands.

594 National and State Forest Range Administration. Cr. 3 to 9. Summer Camp
Messrs. McComb, MacDonald
Prerequisite: Bot. 424.
Detailed field studies of administration and management of range areas on national and state forests.

Courses of special interest to forestry students:
Agron 357 Forest Soils See Page 170
Bot 256 257 Dendrology See Page 186
Bot 416 Forest Pathology See Page 186.
Chem 259 Chemistry of Forest Products See Page 197
C E 310, 312, 313 Surveying See Page 204
Zool 377 Forest Insects. See Page 329.

Courses for Graduate Students

600. Research. F.W.S.
Messrs Bensend Kellogg, McComb, MacDonald

604. Advanced Silviculture. Cr. 2 to 5 F.W.S.
Mr. McComb
Prerequisite: 303.
Research methods in silviculture Studies in silvicultural practice in given regions, involving special marketing, land use, climatic, edaphic, or biotic conditions.

606 Advanced Planting. Cr. 2 to 5 S.
Messrs. McComb, MacDonald
Prerequisite: 206.
Forest nurseries. Special problems in tree planting and reforestation.

634 Advanced Lumbering. Cr. 2 to 5. F.
Mr. Bensend
Prerequisite: 224.
Investigations and reports on logging, milling, transportation, and marketing lumber and other timber products.

688, 689. Forest Industries. Cr. 2 to 5 each. W.S.
Messrs. Bensend, Hartman
Prerequisite: 487.
Industries depending upon forest products, including paper and pulp, veneer, naval stores, wood distillation, timber preservation, and other minor industries.

694. Advanced Forest Management. Cr. 2 to 5. F.
Prerequisite: 498
Special problems in regulation of forest yield. Forest working plans.

697 Advanced Forest Protection. Cr. 2 to 5. W
Messrs. McComb, MacDonald
Prerequisite: 390.
Agencies injurious to forest, especially fire. Fire control plans, cooperation with federal agencies. Timber protective associations

General Engineering

JOSEPH KENNETH WALKUP, A.B., B.M.E., I.E., Head of Department

Professors: Forest Charles Dana, C.E.; Jean Charles Hempstead, C.E.; James Percival McKean, M.S., LL.B.

Associate Professors: Lawrence Robertson Hillyard, M.S.; Marion Blanchard Richardson, M.E.

Assistant Professors: John Ronald Frazer, M.S.; George Henry Frost, B.S.; Arthur Charles Kleinschmidt, M.S.; Jack Parker Mills, M.S.; Wayne Robert Moore, B.S.

Instructor. Cowles

Opportunities for Undergraduate Study

For undergraduate curriculum in general engineering leading to the degree of Bachelor of Science, see page 122

The General Engineering curriculum affords essential training to men who have an aptitude for engineering and a potential capacity for management which should enable them to choose careers in industrial production, personnel or management and in business operations and sales. These fields of endeavor are found in such industrial enterprises as manufacturing of both capital and consumer goods, public utilities, and with industrial insurance companies.

In the junior and senior years the student is offered the opportunity of specializing in courses directed toward industrial operations (Industrial Engineering Option) or electing those courses which are most applicable to his future endeavors.

The department offers a cooperative program leading to the degree of Bachelor of Science in General Engineering and a law degree from a recognized law school in a minimum time Students wishing to follow a cooperative program in General Engineering and Law as stated on page 67 should contact their counsellors early in the sophomore year to obtain a special classification in course sequences.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in industrial engineering and in engineering valuation and for the degree of Doctor of Philosophy in engineering valuation, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of curriculum substantially equivalent to that required of undergraduate students in engineering at this institution

Open to graduate students for minor only. 351, 362, 404, 407, 421, 425, 426, 432, 435, 436, 452, 462.

Description of Courses

Courses Primarily for Undergraduate Students

100. **Technical Lecture.** (1-0-0) Required. **S.**
Lectures and conferences designed to aid the freshman student to adjust himself both in his course and in college environments

105 **Engineering Problems.** (1 0 2) Cr. 1 **F.W.S.**
Prerequisite Credit or classification in Math 102 or 102x
Development of skills and orderly methods of solving problems involving computations of an engineering character. Basic calculating techniques; longhand, slide rule and logarithms. Application of trigonometry and background mathematics to the solution of engineering problems.

106 **Engineering Problems.** (1-0-2) Cr. 1. F.W.S.
Prerequisite: Credit or classification in Math 103
Development of skills and orderly methods of solving problems involving computations of an engineering character. Basic calculating techniques; longhand, slide rule and logarithms. Application of mathematics to solution of engineering problems.

108. **Methods of Engineering Computations.** (0-0 3) Cr. 1 F.W.
Prerequisite: Transfer credit in Math 103, 211
Training in skills, standards and methods essential for engineering computations. To assist transfer students in adjusting to divisional standards.

122. **Engineering Problems.** (0-0 3) Cr 1. F.W.S.
Prerequisite: Credit or classification in Math. 211.
Application of differential calculus and background mathematics to problems of engineering, training in orderly methods of solving problems.

213. **Seminar.** (1 0-0) Required. F.W S
Required of all third-quarter sophomore students. Required of senior college transfer students in the first quarter after transfer to the General Engineering Department May be taken concurrently with 311.

223. **Motion Study.** (0-1-3) Cr. 2. W.S
Prerequisite: M E 201 or M E 204
Principles and applications of motion economy in industrial processes

311. **Seminar.** (1 0-0) Required. F.
325, 326. **Summer Work.** Cr. 3 each.
Prerequisite: Advance approval of the head of the department
Approved summer work in industrial plants

351. **Industrial Organization.** (0-3-0) Cr. 3. F.W.S.
Prerequisite: Senior college classification Also Ec. 262 for General Engineering students.
Industrial tendencies, ownership, types of organization; the principles and methods of production control, inspection, motion and time study, wage systems, cost control and personnel relations in the co ordination of an industrial organization.

354 **Employment Methods and Employee Development.** (0 2-3) Cr. 3. F.W.
Prerequisite: Psych. 204.
Principles and technique of employment methods and their relation to industrial development.

362. **Calculations and Graphic Methods.** (0 3 0) Cr. 3. F.W
Prerequisite Math. 212 and senior college classification.
Selective tabulation and analysis of mass data by graphic and selected statistical methods, graphic presentation of industrial engineering and management data.

400. **Senior Inspection Trip.** Required. F
Prerequisite: Senior Gen.E. classification
One week spent in industrial centers visiting and inspecting industrial plants.

404. **Engineering Economy.** (0-2 2) Cr. 3. F.W.S.
Prerequisite Ec 262. Also Ec 480 for General Engineering students
Application of fundamentals of economics to engineering alternatives in planning, developing and managing industrial projects.

407. **Engineering Valuation.** (0-3 0) Cr. 3. F.W S.
Prerequisite Ec 261, Ec. 384A or permission of instructor. Credit in 404 will be required of General Engineering students.
Concepts of value, original cost, and reproduction cost, property records, methods of estimating depreciation for valuation and accounting; intangible values, cost values, earning values, rate base, and valuation for taxation, rates, financing, insurance and sales.

412. **Seminar.** (1-0 0) Required W.

421. **Safety Engineering.** (0-3-0) Cr. 3. F.W.S.
Prerequisite: 351.
Principles of accident prevention in industry; training for and selling safety, safe machine design and guarding. Industrial compensation and safety legislation.

425 **Principles of Personnel Supervision.** (0 3-0) Cr. 3. F.W.S.
Prerequisite 351, Psych 204 Also 354 for General Engineering students.
Discussion of problems relating to human contacts arising in the course of employment, with desirable approaches to their solution.

426 **Personnel Management.** (0 3 0) Cr. 3. S.
Prerequisite 425
Problems relating to personnel management, stressing organization and universally significant managerial functions, procedures and relationships

430. **Sales Engineering.** (0 3-0) Cr. 3. F.W.S
Prerequisite: Senior college classification.
Basic principles and fundamentals of selling and their relation to problems of administration of sales departments in industrial concerns.

432. **Job Evaluation.** (0 2 6) Cr. 4. F.S.
Prerequisite: 485
Determining requirements of jobs, analysis for degree and extent of major job factors, weighting of factors, development of basic hourly rate curves, salary classifications, administrative procedures. Practice in description and evaluation.

435. **Introduction to Time and Motion Study.** (0 2 3) Cr. 3. W.S
Prerequisite: 223, 351. Also 862 for General Engineering students.
Introduction to principles and practice in stop-watch time study. Elementary formula construction. Industrial uses of time study standards

436. **Standard Time Determination.** (0 2 3) Cr. 3. F.
Prerequisite: 435
Principles and methods of motion and time study using pre-determined elemental time systems. Formula construction, wage incentives, review of current literature, laboratory practice and industrial projects.

441. **Industrial Engineering.** (0-3 6) Cr. 5. F.
Prerequisite: 436, Ec. 480
Operations, machines and processes required for typical manufacturing problems; selection, specification and layout of equipment and plant facilities, balancing schedules, budget preparation.

442. **Industrial Engineering.** (0 3-6) Cr. 5. W.
Prerequisite: 441, M.E. 344.
The development of organization charts and standard crews, the determination and the design of records of performance to be used in the administrative control of a typical manufacturing enterprise.

443. **Industrial Engineering.** (0 3 6) Cr. 5 S
Prerequisite: 442.
The development and application of inventory records, load charts, production orders, schedules, production reports, progress reports and control reports to a manufacturing problem in such a manner as to keep a continuous comparison between planned and actual results.

446. **Manufacturing Methods.** (0 3-0) Cr. 3 F.W.S
Prerequisite: M.E. 201, 423.
Study of construction and performance of machine tools, production methods; design and economic use of jigs and fixtures; special tools and gauges. Progressive assembly.

452. **Industrial Management.** (0 3 0) Cr. 3. S
Prerequisite: 404, 425, 435.
Management of industrial operations by application of advanced theoretical principles and quantitative techniques.

462. **Engineering Inspection.** (0 3-0) Cr 3. S
Prerequisites: 351, 362 or Stat. 302.
Inspection department functions and organization, quality control procedures, acceptance sampling, and cost studies.

486. **Industrial Engineering.** (0 3-0) Cr. 3. F.S.
Prerequisite: 351.
Factory location and operation, orders and records, purchasing, storing, routing, scheduling, dispatching, costing, general management theories.

489. **Factory Planning.** (0 1-6) Cr. 3 W.S
Prerequisite: 351, M.E. 344.
Selection and layout of machinery, power apparatus, heating, ventilating, and lighting systems; size and type of buildings.

494. **Special Problems.** Cr. 1 to 5. F.W.S.
Prerequisite: Senior classification and permission of head of department
Formulation and solution of theoretical or practical problems which relate to manufacturing, public utility operation, operation of communication systems or other industrial methods.

Courses for Advanced Undergraduate and Graduate Students

511. **Legal Aspects of Engineering Administration.** (0 3 0) Cr. 3. F.
Prerequisite: Ec. 365 or M E. 480, Gen E. 351 and permission of instructor.
Mr. McKean
Engineering management contacts with public administrators and administrative law.

512. **Taxation Aspects of Engineering Administration.** (0 3 0) Cr. 3 W.
Prerequisite: Ec. 384, Gen E. 511 and permission of instructor Mr McKean
Concepts of advalorem, income and excise taxes and their effects on industrial operations and policy making.

513. **Patent Aspects of Engineering Administration,** (0 3 0) Cr 3. S
Prerequisite: Ec 365 or M E 480, Gen E. 351 and permission of instructor. 511 desirable.
Management problems concerning patents, trademarks, franchises, copyrights and royalties.

517. **Engineering Valuation Practice.** (0 2 3) Cr 3 F.S.
Prerequisite: 407. Messrs. McKean, Winfrey
Application of principles of engineering valuation including field work; preparation and pricing of inventories, valuations for utility rates, security regulations, condemnations, sales, estate settlements, and for determining fixed capital costs.

518. **Depreciation Estimates.** (0 3 0) Cr 3 W.S.
Prerequisite: 407. Mr. Winfrey
Collection and analysis of retirement data. Techniques required for the construction of survivor, probable life, condition percent, and accrued depreciation curves for property groups. Analysis of the effect of growing, declining and stable properties on depreciation estimates.

532. **Engineering Aspects of Wage Determination.** (0 2 3 or 6) Cr. 3 or 4. S.
Prerequisite. 432 or permission of instructor. Mr. Walkup
Critical survey of wage programs founded on job evaluation; merit rating, wage incentives, basic hourly wage curves, salary classifications and administrative programs.

536 **Theory and Principles of Work-Time Relationships.** (0 2 3) or (0-3-6) Cr. 3 or 5. S.
Prerequisites: 436 or permission of instructor Mr Walkup
Evaluation of time study systems using pre-determined elemental time standards; comparison with stop watch time study. Applications to industrial situation. Analysis of current literature.

594. **Special Topics.** Cr. 1 to 5 each time elected. F.W.S.
A. Management problems in engineering valuation and depreciation. Messrs. McKean, Winfrey
B. Management problems in personnel. Messrs Hempstead, McKean, Richardson
C. Management problems in industrial engineering. Messrs Frost, Kleinschmidt, Walkup

Courses for Graduate Students

601. **Seminar.** Required. F.W.S. Mr. Walkup

602. **Depreciation Accountancy.** Cr. 2 to 6 each time elected. F.S.
Prerequisite: 518 and Ec. 384 or equivalent. Messrs. McKean, Winfrey
Unit and group methods of accounting for depreciation; reserve requirements; adjustment of depreciation rates and reserves; classification of accounts, property accounting methods. Income tax regulations.

603. **Court and Commission Practice.** Cr. 2 to 6 each time elected. W S
A *Prerequisite:* 517 and Ec 460 Messrs. McKean, Winfrey
Utility rates property valuation and depreciation
B *Prerequisite.* 511 and permission of instructor. Mr. McKean
Legal relations in industry.

604 **Engineering Valuation Research.** Messrs. McKean, Winfrey

605. **Industrial Engineering Research.** Cr. 1 to 5. Mr. Walkup

685. **Factory Personnel.** Cr. 3 to 5. Messrs. McKean, Roudebush
Employment departments; time and wage problems, shop committees, housing conditions, and industrial relations.

688. **Manufacturing Costs.** Cr. 3 to 5. F W.S.
Messrs. Roudebush, Walkup
Overhead and prime costs; machine-hour rate in distributing burden; departmental reports; graphical analysis.

Genetics

JOHN W. GOWEN, Ph.D, Head of Department

Professor: Joseph George O'Mara, Ph D.

Assistant Professors: J. Bruce Griffing, Ph.D.; Janice Stadler, M.A.

Instructors: Banach, Rothenbuhler, Vincent

Opportunities for Undergraduate Study

For undergraduate curriculum in science, major in genetics, leading to the degree of Bachelor of Science, see page 144

The Department of Genetics offers instruction in the science of heredity, and in the operation of the laws of inheritance in domestic animals, in economic plants and in human populations. The courses are also intended to demonstrate the broad cultural and philosophical aspects of this biological science.

Opportunities for Graduate Study

The Department offers major work for the degrees of Master of Science and Doctor of Philosophy in genetics, and minor work to students taking major work in other departments.

Prerequisite to major work is the completion of a thorough undergraduate curriculum in agriculture, or in a biological science, with evidence of good scholarship and aptitude for scientific research.

Students taking major work in genetics will ordinarily take minor work in agronomy, animal husbandry, bacteriology, biochemistry, botany, horticulture, mathematics, veterinary medicine or zoology.

Description of Courses

Courses Primarily for Undergraduate Students

200. **Basic Genetics.** (3-0-0) Cr. 3. W.
For farm operation students
Basic principles of genetics and their relation to plant and animal breeding Not acceptable for bachelor's degree credit.

300. **General Genetics.** (3-0-0) Cr. 3. F.W.
Prerequisite: Course in botany or zoology.
Fundamental principles of genetics and their operation in plant, animal and human populations.

305. **Elementary Laboratory.** (0 0-2) Cr. 1. F.W.
Prerequisite: Should accompany or follow 300.
Laboratory experiments illustrating the laws of heredity.

Courses for Advanced Undergraduate and Graduate Students

500. **Genetics, Evolution, and Biology.** (3-0-0) Cr. 3. S.
Prerequisite: 300. Mr. O'Mara
Integration of modern theories and knowledge of evolution and genetics.

536. **Genetic Statistics.** (Stat. 536) **See Statistics.**

540. **Special Topics.** (0 0 3 to 9) Cr. 1 to 3. F.W S.
Prerequisite: Elementary genetics. Messrs. Gowen, Griffin, O'Mara

567, 568, 569. **Introduction to Biophysics.** (Bact. 567, 568, 569, Phys 567, 568, 569) See Physics.

Courses for Graduate Students

605. **Cytogenetics.** (Bot. 605) **See Botany.**

630. **Advanced Genetics.** (3 0-2) Cr. 4. W.
Prerequisite: Elementary genetics. Mr. O'Mara
Fundamental theories in genetics, including mutation, linkage, selection, biometry, sex-determination and heterosis.

635. **Animal Genetics.** (3-0-2) Cr. 4. S.
Prerequisite: Elementary genetics Mr. Gowen
Principles of inheritance and their application to farm animals, including methods of breeding for economic characters, known genes, use of hybridity, linkage, chromosome abberation, disease resistance and X-ray analysis of gene structure.

650. **Seminar.** Cr. 1. Messrs. Gowen, O'Mara

654. **Genetics of Breed Improvement.** (A.H. 654) **See Animal Husbandry.**

655. **Breeding Systems and Plans.** (A.H. 655) **See Animal Husbandry.**

660. **Research.** Messrs. Gowen, O'Mara

Geology

CHALMER J. ROY, Ph.D., Head of Department

Professor: Charles Sumner Gwynne, Ph.D.

Associate Professors: Keith Morgan Hussey, Ph.D.; Leo Almor Thomas, Ph.D.

Instructor: Carlson

Opportunities for Undergraduate Study

For undergraduate curriculum in science, major in geology, leading to the degree of Bachelor of Science, see page 144.

The department offers fundamental courses in geology designed to give the student a knowledge of the composition of the earth, the processes which are at work upon it, and its history. For those who plan to engage in professional work in the field of geology a sequence of more advanced courses in the various subdivisions of the science is provided, continuing through the junior and senior years. In the senior year such students may take courses particularly applicable to specialized fields of geology. At least one year of graduate work is essential for those planning to engage in professional geological work.

Undergraduate majors in this department usually have included the following basic courses in their programs: 200, 202, 203, 253, 354, 355, 356, 400, 435 and 15 additional credits in courses numbered above 300. As supporting work, undergraduate majors have found the following courses desirable: Bot. 100 and Zool. 101, 102, 103; Chem. 101, 102, 103; Engl. 205, 414; Math. 101, 102, 103, 211, 212, 213; Phys. 211, 212, 213, 309. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counselors who wish to estimate the amount of basic, non-specialized study which may be needed.

Minor work should be taken in two of the following: chemistry, mathematics, mathematics and statistics, physics, zoology, mining engineering, civil engineering.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in applied geology, and minor work to students taking major work in other departments.

Students desiring to major in geology should have completed the equivalent of the following courses: 202, 203, 354, 355, 356; and 400, 434, 435, 436, or 454, 455.

Minor work is usually recommended in mining engineering, chemistry, physics, or zoology.

Open to graduate students for minor only: 355, 400, 434, 435, 436, 454, 455.

Description of Courses

Courses Primarily for Undergraduate Students

200. Introduction to Geology. (0 0 6) Cr 3 F.W.S
The astronomical relationships of the earth, the nature and effects of internal and external earth processes and an introduction to the history of the earth and of life upon it. Occasional field trips will be included

202 Physical Geology. (3 0 0 or 3) Cr 3 or 4 F S
Prerequisite: 200, except for students who are required to take 202 only.
The earth; its composition, structure, and internal and external processes. The nature and origin of minerals, rocks, landscapes, volcanoes, and mountain ranges. Field trips.

203. **Historical Geology.** (3 0 0 or 3) Cr. 3 or 4. F.S.
Prerequisite: 200 or 202.
Methods of investigating the history of the earth and its inhabitants; significant events in the development of the earth and of the plant and animal kingdoms. Field trips.

253. **Elementary Petrology.** (0 1-6) Cr. 3. F.S.
Prerequisite: 200 or 202.
The classification, identification and description of the common rocks and rock-forming minerals. Field trips.

304.** **World Geography.** (3-0-0) Cr. 3. W.
Prerequisite: 200.
World-wide consideration of the elements of geography, physical and cultural, and the interrelation between them and man.

305.** **Economic Geography.** (3 0 0) Cr. 3. S.
Prerequisite: 304.
Occurrence and distribution of natural resources; their relations to commercial and industrial enterprises.

309. **Introduction to Exploration Geophysics.** (Physics 309) See Physics

331. **Geologic Interpretation of Aerial Photographs.** (0-1-6) Cr. 3. F.S.
Prerequisite: 202.
Principles of aerial photography and the use of aerial photographs in the analysis and interpretation of landscapes and geologic structures.

354. **Structural Geology.** (0-3-0) Cr. 3. F.
Prerequisite: 203.
Structure of earth's crust and interpretations of rock structures.

355. **Mineralogy.** (0-2 6) Cr. 4. F W.
Prerequisite: Chem 102.
Fundamentals of cystallography and determinative and descriptive mineralogy.

356. **Petrology.** (0-2 6) Cr. 4 S.
Prerequisite: 253, 355.
Physical, mineralogical, textural, and structural characteristics of rocks; origin and distribution. Field trips.

374.* **Geology for Engineers.** (0 2 3) Cr. 3. F S
Fundamentals of the science and engineering application. Field trips.

375.* **Agricultural Geology.** (0-2 3) Cr. 3. F.W.S
Fundamentals of the science and agricultural application. Field trips.

399 **Special Problems.** Cr 2 to 4 each time elected. F W S
Prerequisite: Elementary geology, permission of head of department.

400. **Summer Field Work.** Cr. 4 to 12. Required of all major students SS
Prerequisite: 203 and 253.
Field phenomena: geologic surveying and mapping.

401, 402. **Geology of North America.** (0-3-0) Cr. 3 each. W.S
Prerequisite: 253, 354.
Physiography, structure, stratigraphy and mineral deposits of the major geologic divisions of North America. 401, Eastern; 402, Western.

434. **Economic Geology: Principles and Processes.** (0-3 3) Cr. 4. F.
Prerequisite: 354, 356.
Nature and origin of mineral deposits.

435. **Invertebrate Paleontology.** (0 3-3) Cr. 4. F.
Prerequisite: 203.
Characteristics and relationships of invertebrates of fossil record; their use in historical geology. Field trips.

436. **Petroleum Geology.** (0 3 0) Cr. 3. S
Prerequisite: 354.
Origin and manner of occurrence of oil and gas; geological characteristics of important producing regions.

454. **Optical Mineralogy.** (0-2-6) Cr. 4. F
Prerequisite: 355.
Study of minerals with polarizing microscope: optical characteristics of principal rock-forming minerals

455. **Economic Geology: Metallic and Non-Metallic Mineral Deposits.** (0 3 0) Cr. 3. W.
Prerequisite: 434.
Geology applied to mining significant deposits and districts

*Either Geology 374 or 375 is acceptable in substitution for Geology 202 for students who wish to elect additional geology.
**304 and 305 are not acceptable as credit toward a major in geology.

Courses for Advanced Undergraduate and Graduate Students

554. **Advanced Structural Geology.** (0 0 6) Cr. 2. W.
Prerequisite: 354.
Graphic and mathematical solution of structural problems. Mr. Hussey

557, 558. **Advanced Petrology and Petrography.** (0 2-6) Cr. 4 each. W.S.
Prerequisite: 356, 454. Mr. Roy
(557) Igneous and metamorphic rocks. (558) Sedimentary rocks. Field trips.

566. **Seminar.** Cr. 1 each time elected. Required of all graduate students and open to advanced undergraduates with approval. F.W.S.
Messrs. Gwynne, Hussey, Roy, Thomas

567, 568. **Invertebrate Paleontology.** (0-2 6) Cr. 4 each. W.S.
Prerequisite: 435. Mr. Thomas
Application of paleontology to stratigraphic correlation and interpretation of earth history. (567) Paleozoic. (558) Mesozoic and Cenozoic. Field trips.

569. **Micropaleontology.** (0-2 6) Cr. 4. F.
Prerequisite: 203. Mr. Thomas
Fossil protozoa and other small organisms and their use in stratigraphic geology. Field trips.

571, 572, 573. **Advanced General Geology.** (0 3 0) Cr. 3 each. Yr
Prerequisite: 354, 356. Messrs Hussey, Thomas
Principles of dynamical, structural, and stratigraphic geology; form and structure of earth and its history. Field trips.

584. **Engineering Geology.** (0 3-0) Cr. 3. F.S
Prerequisite: 253, and 354 or 374 and permission of instructor. Mr. Gwynne
Geology as applied to the location and design of large structures.

Courses for Graduate Students

664. **Special Topics.**

A. Glacial Geology	Mr. Gwynne
B. Stratigraphy	Mr. Thomas
C. Paleontology	Mr. Thomas
D. Petrology and Petrography	Mr. Roy
E. Dynamic and Structural Geology	Messrs Gwynne, Hussey, Roy
F. Micropaleontology	Mr. Thomas

665. **Research.**

A. Glacial Geology	Mr. Gwynne
B. Stratigraphy	Mr. Thomas
C. Paleontology	Mr. Thomas
D. Petrology and Petrography	Messrs. Gwynne, Roy
E. Dynamic and Structural Geology	Messrs Gwynne, Hussey, Roy

History and Government

CLARENCE HOVEY MATTERSON, Ph.D., Head of Department

Professors: John Roy Mashek, Ph.D.; Earle Dudley Ross, Ph.D.; Louis Bernard Schmidt, Litt D.

Associate Professors.—Herbert Clare Cook, Ph D.; Norman Arthur Graebner, Ph D; J A Greenlee, Ph D; V. Alton Moody, Ph D; William Robert Parks, Ph D.; Paul Frederick Sharp, Ph D

Assistant Professor: Edwin William Peterson, A M

Opportunities for Undergraduate Study

For undergraduate curriculum in science, major in history and government, leading to the degree of Bachelor of Science, see page 144 Major work is offered in the following fields: history, government, or a combination of the two

The department provides fundamental and specialized courses of instruction in history and government for students in all divisions of the College. These subjects are designed: first, to furnish such knowledge and training as it is believed should be part of any college education; second, to provide advanced work for those students who need a knowledge of history and government for teaching or for public service; and third, to train men and women for intelligent citizenship

Undergraduate majors in this department have usually included the following basic courses in their programs: 211, 212, 213, or 311, 312, 313, or 321, 322, 323. As supporting work, undergraduate majors have found the following courses desirable: Ec. 261, 262, 263; Soc. 234B; Engl. 254. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counselors who wish to estimate the amount of basic, non-specialized study which may be needed.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in economic history; and minor work in economic history and in government to students taking major work in other departments.

Prerequisite to major graduate work in the department is the completion of at least thirty quarter credit hours in history and fifteen credits in political science and economics.

Open to graduate students for minor only:

Hist. 401, 402, 403, 425, 430, 465, 495; Govt. 424, 437, 446, 468, 470, 476, 477, 478, 480, 485, 487, 490, 491, 495.

Description of Courses

Courses in History

Courses Primarily for Undergraduate Students

211, 212, 213. **European and American Civilization Since 1305.** (2 1-0) Cr. 3. Yr.
213. *Prerequisite:* 212.
(211) Consideration of conditions in Europe that produced the early movement of people to American shores; the breakup of medieval society, the Renaissance, and the expansion of Europe; the impact of Europe on America; the American Revolution and its results; the French Revolution. (212) The nineteenth century; influences, movements, and developments that set the stage for the civilization of the present. (213) The twentieth century; liberalism and progressivism; prosperity and depression; two world wars—origins, effects on American life.

311, 312, 313. **Introduction to European Civilization.** (0-3-0) Cr. 3 each. Yr.
312. *Prerequisite:* 311.
313. *Prerequisite:* 312.
Social and cultural development of Western civilization from the Ancient Orient to the present, emphasizing economic and political institutions; changes in habits, customs, and ideas; and the background of recent developments.

321, 322, 323. **History of the American Nation.** (0-3-0) Cr. 3 each. Yr.
(321) National Foundations. Colonial background; revolution; confederation and constitutions; nationalism and democracy. F.
(322) National expansion and internal conflict. Forces of unity and disunity; division and reunion W.
(323) National consolidation and world power; emergence of the new nation; modern industrialism and international relations. S.

324. **History of American Agriculture.** (0-3-0) Cr. 3. F.W.S.
Colonial foundations; westward movement; public land policies; regional specialization; transportation and markets; agrarianism and industrialism; farmers' movement; politics and legislation; relation of state to agriculture.

331, 332, 333.† **World Politics and International Organization.** (0-3-0) Cr. 3 each.
(331) Survey of the basic factors underlying international politics: the nation-state system; elements, distribution, and role of national power; objectives of foreign policy; causes of war and conditions of peace.
(332) Application of principles underlying international politics to the power position and foreign policy of the individual nations and to international conflicts and their solution.
(333) Organization and methods devised by states for dealing with their common problems of peace and security; welfare activities at the international level; special attention to the problems arising in the United Nations.

†Any subject listed in the following history sequences may be taken independently: 331, 332, 333, 334, 335, 401, 402, 403.

334, 335.† **Economic History of the United States.** (2-1-0) Cr. 3 each.
334. To 1865. F.
335. Since 1865. W.S.
Growth of important industries; regional specialization; development of economic institutions; and relation of government to business enterprise.

401, 402, 403.† **Economic History of Modern Europe.** (0-3-0) Cr. 3 each. Yr.
Prerequisite: 6 credits in history.
(401) Economic and political revolutions, 1750-1832. English and continental heritage from medieval Europe; mercantilism and laissez-faire; commercial, industrial, agricultural, and political revolutions; economic institutions and reforms. (402) British and continental competition, 1832-1914. Commercial theory and practice; rise of continental industry; changes in agriculture, labor, transportation, money, and markets; protectionism; imperialism. (403) New Europe since 1914. Economic aspects of World War I; revolutions, reparations, reconstruction, and agrarian reforms; liberalism and reaction; competition and war.

425. **Twentieth Century Europe.** (0 3 0) Cr. 3. W.
Prerequisite: 6 credits in history
Europe on the eve of the War of 1914; the War and its effects intellectually, economically, and politically; bases and rise of Fascism and Naziism; the depression and the breakdown of international relations in the 1930's.

430. **The Making of the American Economy.** (2 1 0) Cr. 3. F.
Prerequisite: 334 and 335 or equivalent.
Basic factors and influences, environmental, social, and political that have produced the existing economic systems and institutions.

465. **History of Latin America.** (0-3-0) Cr. 3. F.
Prerequisite: 6 credits in history.
Spanish and Portuguese colonization in America; colonial institutions; wars of independence; development of Argentina, Brazil, Chile and Mexico; emphasis on Pan-Americanism and relations of the United States with Latin America.

490. **Contemporary Affairs.** (0-3-0) Cr. 3. F.W.S.
Prerequisite: 3 credits in history and 3 credits in government.
The significance of current events and their likely implications in view of recent history. Problems of postwar world in view of prewar conditions.

495. **Special Problems.** Cr. 1 to 5 each time elected. F.W.S.
Prerequisite: Permission of the head of the department.
Reading and reports on problems selected in conference with each student

Courses for Advanced Undergraduate and Graduate Students

522. **Social and Intellectual History of the United States.** (2-1-0) Cr. 3. S.
Prerequisite: 9 credits in history and government. Mr. Ross
Development of social and intellectual movements, institutions, and leaders.

526. **Development of the United States Constitution to 1865.** (0-3-0) Cr. 3.
Alt W. Not offered 1953
Prerequisite: 9 credits in history or government. Mr. Graebner
Constitutional heritage from England; colonial contributions to constitutional development; making the Constitution; problems of the new government; development of constitutional activities through Supreme Court decisions; effect of the Civil War on the Constitution.

527. **Development of the United States Constitution Since 1865.** (0 3 0) Cr. 3.
Alt. S Not offered 1953
Prerequisite: 9 credits in history or government Mr. Graebner
Constitutional aspects of reconstruction; governmental regulations of banking, agriculture and business; expansion of governmental functions; emphasis upon constitutional significance of the World Wars, the Progressive movement and the New Deal.

534. **The Westward Movement.** (0 3 0) Cr. 3. W.
Prerequisite: 9 credits in history. Mr. Ross
The west under Spain, France and England; territorial acquisitions; westward migration to the Mississippi; economic, political and social development of the frontier; settlement of the prairie states.

535. **The Trans-Mississippi West.** (0-3-0) Cr. 3. S.
Prerequisite: 9 credits in history. Mr. Ross
Exploration and settlement of the Great Plains and Rocky Mountain areas; the development of fur trade, cattle and mining kingdoms; social and institutional modifications; passing of the frontier; effect of the Far West on national development.

540. **The Farmers' Movement in the United States.** (0 3 0) Cr. 3. F.W.S.
Prerequisite: 6 credits of history and 3 credits of government or permission of instructor. Mr. Schmidt
Colonial and revolutionary origins, agrarian foundations of Jeffersonian and Jacksonian democracy; national nonpartisan farm organizations; political third parties; influence on politics and legislation. Role of public organizations. Influence of agricultural journalism. Techniques of agrarian pressure groups. Rural-urban and agrarian-industrial interdependence and coordination.

†Any subject listed in the following history sequences may be taken independently: 331, 332, 333, 334, 335, 401, 402, 403.

554. **Foreign Relations of United States, 1775-1898.** (0 3 0) Cr. 3. Alt. W. Offered 1953
Prerequisite: 9 credits in history and government. Mr. Graebner
European background; French alliance and independence; struggle for neutrality; Monroe Doctrine; diplomacy of westward expansion; War between States; and economics of diplomacy.

555. **United States as a World Power Since 1889.** (0-3-0) Cr. 3. Alt. S. Offered 1953
Prerequisite: 9 credits in history and government. Mr. Graebner
The "New Manifest Destiny" of the United States; American interests and policies in Europe, Latin America, and the Far East; isolation to intervention in the world wars of 1914 and 1939; the United States in the postwar world.

568. **Contemporary International Relations.** (0-3-0) Cr. 3. F.
Prerequisite: 9 credits in history and government. Mr. Sharp
Nature and foundations of international relations; nationalism and imperialism; economics of world politics; foreign policies of Great Powers; and international organization versus power politics.

580. **Recent European Agrarian Reform.** (0-3-0) Cr. 3. S.
Prerequisite: 403. Mr. Moody
Concentration of land ownership; resulting poverty; demand for change; obstacles; authorization; legislation; expropriation; finance; distribution; progress; criticism; results.

590. **Special Topics in Economic History.** Cr. 2 to 5 each time elected. F.W.S.
Prerequisite: 9 credits in history and 3 credits in government.
Messrs. Matterson, Moody, Ross, Sharp
American and European economic history. International economic relations. Bibliography and historiography of economic and social history.

Course for Graduate Students

604. **Research in Economic History.**
Messrs. Moody, Ross, Sharp

Courses in Government

Courses Primarily for Undergraduate Students

315. **American Government.** (0-3-0) Cr. 3. F.W.S.
Fundamentals of democracy; nature of federalism; organization, functions, and working relation of national government to agriculture, business, industry, and commerce; role of citizens and parties.
A. For agriculture, home economics, science, and veterinary medicine students.
B. For engineering students.

424. **State and Local Government in the United States.** (0 3-0) Cr. 3. F.
Prerequisite: 315.
Organization and functions; state regulation and operation; special problems including reorganization of state and local government; consolidation of governmental areas; financial control; state civil service.

437. **Municipal Government and Administration.** (0-3-0) Cr. 3. F.W.S.
Prerequisite: 315.
Rise of city in American life; legal position of municipal corporation; forms of organization; personnel and fiscal administration; planning; streets and lights; police and fire administration; public health; recreation; water supply; sanitation; schools; libraries; public welfare administration; utility regulation.

446. **European Governments.** (0 3 0) Cr. 3. Alt S. Offered 1952
Prerequisite: 315.
Comparative examination of governments of England, France, Germany, Russia, Italy, and Switzerland; political problems of those states; comparisons with United States.

468. **Political Parties.** (0-3-0) Cr. 3. Alt. F. Offered 1952
Prerequisite: 315.
Origin and development; relation to democratic process; membership and organization; nominations and elections; persistence of spoils system; campaign strategy; party finance; machine and bosses; party realignment.

470. **Public Opinion and Pressure Politics.** (0 3-0) Cr. 3 Alt. S. Not offered 1953
Prerequisite: 315.
Nature of public opinion in a democracy; relationship of public opinion and public interest; various agencies and pressure groups influencing public opinion; their effect upon governmental policies and governmental personnel; importance of political education.

476. **Public Administration.** (0-3-0) Cr 3. W.
Prerequisite: 315.
Principles applied to national, state, and local governments; problems of organization, personnel, purchasing and supply; financial procedure; problems and tendencies in the national and Iowa governments

477. **Governmental Budgeting.** (0 3 0) Cr. 3. Alt. S. Offered 1953
Prerequisite: 315.
Planning, control and administration in governmental financial systems in the United States—national, state and local; historical development of these systems; organization and structural features of the financial control agency; relations to other governmental agencies; administration; accounting; treasury operation; financial planning and investigation; assessment; procurement; auditing.

478 **Public Personnel Administration.** (0 3 0) Cr. 3. Alt. S. Not offered 1953
Prerequisite: 476.
Civil service systems in the United States, national, state, and local; history of civil service; development of the merit principle; administration of recruitment, selection, classification, promotion, service ratings, discipline, retirement and employee organization.

480. **Government and Industry.** (0-3-0) Cr. 3. S.
Prerequisite: 315.
Theories of constitutional protection; governmental assistance to business and agriculture; government and labor; corrective legislation in corporate organization; unfair practices; securities issues; business and taxation; bankruptcy; business with a public interest.

485. **Political Science in Theory and Practice.** (0-3-0) Cr. 3. W.
Prerequisite: 315.
Analysis of basic concepts; popular sovereignty, liberty, power, justice. Governmental techniques as applied to the democratic process: constitutions, political parties and public opinion, representative systems, legislatures, bureaucracy, government career service.

487. **American Political Thought.** (0-3 0) Cr. 3. S.
Prerequisite: 315.
Analysis of main trends in the development of American political ideas, political institutions and governmental policies; an attempt to explain the geographic, economic, social and cultural forces motivating the development of American political thought; to indicate the relation of the developing theories to reality; and to show how theories determine subsequent political actions.

490 **Government and Agriculture.** (0 3 0) Cr. 3. F.
Prerequisite: 315.
Agriculture as a major interest in American life; tasks of government as umpire of conflicts among pressure groups; organization and operation of governmental administrative agencies serving agriculture; examination of court decisions involving agriculture; analysis of farm programs.

491. **Agricultural Administration.** (0 3 0) Cr. 3. W.
Prerequisite: 490 or equivalent.
Analysis of the major problems in administering public agricultural programs, including federal state-local relations; coordination of programs; adapting national programs to local needs, and securing democratic and effective farmer participation in these programs.

495. **Special Problems.** Cr 2 to 5. F.W.S.
Prerequisite: Permission of the head of the department.
National, state, and local governments: governmental reorganization; tax revision; congressional investigation; labor relations regulation of commerce, industry and agriculture; current party problems.

Home Economics

P. MABEL NELSON, Ph.D., Dean of Home Economics

PAULENA NICKELL, Ph.D., Associate Dean

ELIZABETH TAYLOR SHEERER, Ph.D, Assistant to the Dean

LOCHEEN GUNN THOMAS, B.S. Personnel Officer

Opportunities for Undergraduate Study

For undergraduate curricula in home economics leading to the degree of Bachelor of Science, see pages 128-141.

Description of Courses

Courses Primarily for Undergraduate Students

105. **Personal Adjustment for Professional Home Economics.** (0-2-0) Cr. 2. F.W.S.
Information needed for choices of vocation; personal qualifications for living and working with people; planning for self while in college; personal social experience in college; scope of home economics.

319. **Marriage and the Family.** (Soc. 319) See Sociology.

400. **Professional Relations.** Required. F.W.
Prerequisite: Senior classification.
Procedure in securing positions. Employer-employee relationship.

Home Economics Education

FLORENCE A. FALLGATTER, M.A., Head of Department

Professors: Hester Chadderdon, Ph.D.; Mary Stewart Lyle, Ph.D.; Mattie Pattison, Ph.D.

Associate Professor. Dagmar Hildegarde Johnson, Ph.D.

Assistant Professors: M. Evelyn Chapin, M.S.; Blanche Rose Miller, M.S.; Edna Elinor Mundt, M.S ; Gladys Theresa Olson, M.S.

Instructors: Cleveland, Dudley, Alice Johnson, Nelson, Rust, Thompson

Opportunities for Undergraduate Study

For undergraduate curriculum in home economics education leading to the degree of Bachelor of Science, see page 138.

The curriculum in home economics education is planned for those who wish to prepare for teaching in junior and senior high schools. By utilizing some elective credits for certain courses, this curriculum also prepares for the home economics extension service. Admission to all education courses requires a quality point average of 2.1.

For details of state teacher certification, see Vocational Education, page 321 The requirement of at least 15 quarter credits in each of two subject matter fields in addition to home economics should be noted.

For description of courses in vocational education, agricultural education, rural education, and industrial education, see Department of Vocational Education, page 320.

Vocational Education Qualifications

The Department of Home Economics Education is approved by the State Board for Vocational Education for the training of teachers of homemaking who desire to teach in the federally-aided schools of the state.

Preparation for Home Economics Extension Service

Students in Home Economics Education will have a strong basic background for home economics extension service. For specific preparation, V. Ed. 467 should be included as well as elective courses that are planned in consultation with the assistant extension director in charge of home economics. V. Ed. 466 is also strongly recommended.

Students registered in other departments must consult with the assistant extension director early in the Junior year in order to plan for the most effective use of

elective credits for courses that are needed for extension. These should include V. Ed. 466 and 467.

Summer employment as assistants to county extension home economists provides invaluable experience for the potential extension worker. It should be considered between the Junior and Senior years

Opportunities for Graduate Study

See Department of Vocational Education, page 320

Description of Courses

Courses Primarily for Undergraduate Students

405. Observation of Teaching. (0-1-3) Cr. 2. F.W.S.
Prerequisite: Credit or classification in V.Ed 305
Guided observation of teaching as a basis for applying educational principles to homemaking instruction.

406. Methods of Teaching Home Economics. (0 2-0) Cr. 2. F.W.S.
Prerequisite: 405, V.Ed. 305.
Learning experiences in school, home and community. Evaluation in terms of pupil growth. Growing philosophy of education for home and family life.

407. Supervised Teaching in Home Economics. Cr. 5. F.W.S.
Prerequisite: C.D. 536, F &N. 303, T.&C. 324, credit or classification in H.Ed 406
Supervised teaching in public schools for periods of six or twelve weeks. Advance reservation with head of department required.

409. Planning and Evaluating the Home Economics Program. (0 3-0) Cr. 3. F.W.S.
Prerequisite: 407.
Program planning with special emphasis on curriculum, evaluation and extra-class responsibilities.

415. Principles of Education for Dietitians. (0 2 0) Cr 2. F.W.
Prerequisite: F.&N. 305.
Bases for curriculum planning of dietetic units offered to nurses, patients, employers, doctors and dentists.

Courses for Advanced Undergraduate and Graduate Students

504. Special Topics. F.W.S.
Prerequisite: 406.
A Adult Education. Miss Lyle
B. Counseling in Home Economics. Miss Sheerer
C. Curriculum. Miss Pattison
D. Evaluation. Miss Chadderdon
E. Extension. Miss Fallgatter
F. Supervision. Misses Fallgatter, Pattison

508 Adult Education in Homemaking. (0 2 2) Cr. 3 F.W.S.
Prerequisite: Credit or classification in 407 Miss Lyle
Philosophy of adult education and of education for homemaking and family life for adults. Observation of adult groups. Participation in organizing and planning for adult groups.

512. Interpersonal Relations in Home Economics. (1-2 0) Cr. 3. F.W.
Prerequisite: 9 credits in psychology or 6 credits in psychology and 6 credits in education. Miss Sheerer
Implications of client centered counseling for the home economist whose work involves informal counseling

Courses for Graduate Students

605. Home Economics Curricula. (0 3 0) Cr. 3. F
Prerequisite: Credit or classification in 406, teaching experience. Miss Pattison
Bases and techniques of curriculum building applied particularly to home economics in secondary schools.

606. Technique of Supervision. (0 3 0) Cr. 3. S.
Prerequisite: 407 or equivalent.
Function of supervision in the educational program Objectives, techniques, and organization of supervised teaching programs and state supervision

607. **Survey of Present-Day Trends in Teaching Home Economics.** (0 4 or 6-0) Cr. 2 or 3. SS.
Prerequisite: Teaching experience. Miss Fallgatter
Analysis of offerings and procedures in educational programs for home and family living for all age groups.

608. **Workshop.** Cr. 1 to 5. SS.
Prerequisite: Permission of instructor
Concentrated group study of problems in fields of Home Economics Education indicated in section A to E. Sections offered will vary from year to year.
A. Adult Education. Miss Lyle
B. Evaluation. Miss Chadderdon
C. Home Economics Curriculum. Miss Pattison
D. Supervision and Administration. Miss Fallgatter
E. Special.

610. **Seminar.** Credit as arranged.
Misses Chadderdon, Fallgatter, Pattison

612. **Evaluation in Home Economics.** (0 2-0) Cr. 2. W.
Prerequisite: 12 credits in education or permission of instructor. Miss Chadderdon
Selection and construction of evaluation devices. Their use and interpretation in home economics programs.

614. **Research.**
Misses Chadderdon, Lyle, Pattison

Home Management

PAULENA NICKELL, Ph.D., Head of Department

Professor. Margaret Isabel Liston, Ph.D.

Associate Professors: Marie Alverta Budolfson, M.S.; Fannie Alice Gannon, B.S.

Assistant Professor: Naomi Dorothy Shank, B.S.

Instructor: Babcock

Opportunities for Undergraduate Study

For undergraduate curriculum in home management leading to the degree of Bachelor of Science, see page 139.

The home management curriculum is designed primarily for students who wish to prepare for graduate study in home management and family economics. Students with special interest and ability in the fields closely related to home management, such as consumer economics, family relations and sociology, or household equipment, may elect a sequence of courses in one of these fields.

Any students interested in undergraduate study in housing may register for the home management curriculum and arrange a sequence of elective courses by consultation with the Dean of Home Economics and the Head of the Home Management Department.

Opportunities open to the student with a bachelor's degree in home management are: graduate study for college teaching and research; training in social welfare; business, where a background of management and consumer economics is desired.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of one year's work in each of the following: elementary design; textiles and clothing; economics and sociology; foods and nutrition, including elementary foods, meal planning, and

dietetics; one course each in child development, home management, general psychology, and residence in a home management house.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only 474, 475.

Description of Courses

Courses Primarily for Undergraduate Students

415. **Consumers in the Market.** (Ec. 415) (0 3 0) Cr 3 W.
Prerequisite: Ec 212.
Consumer problems, merchandising practice, and legislation bearing on prices and quality of consumer goods Observation of the market

418. **Family Finance.** (Ec. 418) (0-2 0) Cr. 2. S
Prerequisite: Credit or classification in 474.
Planning, controlling and evaluating family expenditures

474. **General Home Management.** (0 3-0) Cr. 3. F.W S
Prerequisite: C.D. 235, Ec. 212, Soc. 234C, F.&N. 303, classification in 475.
Two-hour periods for six weeks, alternating with 475. Home as influenced by training and expenditure of time, energy, and money; consideration of human values.

475. **Home Management House.** Cr. 4. F.W.S
Prerequisite: C.D. 235, Ec. 212, Soc. 234C, F &N. 303, classification in 474.
Six weeks residence wtih actual experience in certain phases of homemaking and group relationships, arranged group conferences Advance reservation with head of department required

Courses for Advanced Undergraduate and Graduate Students

514. **Economics of the Household.** (Ec 514) (0 3 0) Cr. 3 F.
Prerequisite: Credit or classification in 474 Miss Liston
Contributions of the household to family living factors affecting it, bearing of economic characteristics on management, effect on family and its members

515. **Consumers Marketing.** (Ec. 515) See Economics

516. **Standards of Living.** (Ec. 516) See Economics.

517 **Economics of Housing.** (Ec 517) (0 3-0) Cr. 3. Alt S. Not offered 1953
Prerequisite: Ec 213, or permission of instructor Miss Douglas
Needs and standards; construction and land use; expenditures, cost, and valuation; finance; evaluation of proposed housing programs

520 **Food Economics.** (Ec 520) (0 3 0) Cr 3 Alt S. Offered 1953
Prerequisite: 9 credits in Economics Miss Liston
Food as related to income, prices, advertising, and family size. Efficiency in commercial and household production and marketing State control and adequate nutrition.

579. **Special Topics.** Credit as arranged. F.W.S
Prerequisite Credit or classification in 474 Misses Budolfson, Liston

Courses for Graduate Students

614. **Research.** F.W.S
Misses Hoyt, Liston, Nickell

618. **Advanced Family Finance.** (Ec. 618) (0 3 0) Cr. 3. S
Prerequisite: 474. Miss Liston
Factors affecting adequacy and security of family income. Spending and investment problems, with special reference to consumer credit, insurance, and investment.

619. **Methods of Social and Economic Investigation.** (Ec. 619) (0-3 0) Cr. 3. W.
Prerequisite: 514, or permission of instructor Miss Liston
The nature and purpose of social and economic investigations; sources of material, tests of reliability; methods of collecting, interpreting and presenting data. Analysis of outstanding studies in fields related to students' interests

677 **Seminar.** Credit as arranged F W S
Miss Liston

684. **Supervision.** (0 2 0 or 3) Cr 2 or 3 SS
Prerequisite: 475. Miss Nickell
Organization, supervision, evaluation and methods of conducting home management houses.

Horticulture

ERNEST STRAIGN HABER, Ph.D., Head of Department

Professors: Arthur Thomas Erwin, M.S.; Harry Esmond Nichols, M.S.; *Bethel Stewart Pickett, M.S.; *Julian Claude Schilletter, Ph.D.; Robert G. Tischer, Ph.D.; Emil Conrad Volz, M.S.A.

Associate Professors: Harvey Lee Lantz, M.S.; Clinton E. Peterson, Ph.D.

Assistant Professors: Arthur E. Cott, M.S.; Ervin Loren Denisen, Ph.D.; Edward P. Lana, Ph.D.; John Peter Mahlstede, Ph.D.; Charles H. Sherwood, M.S.

Instructors: Buck, Doll, Lewis, Peterson, Schark

Opportunities for Undergraduate Study

For undergraduate curriculum in horticulture leading to the degree of Bachelor of Science, see page 104.

It is the aim to teach in a logical way the fundamental principles underlying horticultural practice, supplement this freely with demonstrations, and bring the student into contact with the practical operations. The technical courses are well supported by work in fundamental science and cultural courses.

Good openings for horticultural graduates are found in fruit growing, truck farming, floriculture, and in managing and superintending commercial fruit, flower, and vegetable establishments. Positions are also open for managers of co-operative associations, for teachers in colleges, academies, and high schools, and for extension experts in agricultural colleges, railroads, land companies, and horticultural associations. Government agencies and experiment stations also afford desirable employment.

Opportunities for Graduate Study

The Department offers major work for the degrees of Master of Science, and Doctor of Philosophy in horticulture with the option of specializing in pomology, and vegetable crops, floriculture, propagation, and fruit and vegetable processing; and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of courses covering the general field of horticulture and the underlying sciences. Students with major problems in pomology, floriculture, vegetable crops, propagation or fruit and vegetable processing should present the equivalent of 15 quarter credits (10 semester hours) of undergraduate work in their respective fields, one course in general horticulture, and at least one course in one of the other branches of horticulture mentioned above. The student should also have a working knowledge of inorganic and organic chemistry, botany, and soils equivalent to the requirements outlined in the general curriculum for horticultural students at this institution. In exceptional cases undergraduate courses in farm crops, soils, botany, and chemistry may be substituted for horticulture.

Students taking major work in horticulture will usually take minor work in soils, genetics, botany (physiology, pathology, cytology, or morphology), entomology, chemistry, agricultural economics, or vocational education.

Open to graduate students for minor only: 415.

Description of Courses

Courses Primarily for Undergraduate Students

110. Introduction to Horticulture. (1-0-0) Required. S.
Introduction of first-year students to horticulture field; assistance in learning how to use facilities of the College and department to advantage.

*On leave

114. **General Horticulture.** (0-2-2) Cr. 3. F.W.S.
Horticultural enterprises, commercial and home; structures, functions, growth, propagation, cultivation, pruning, training, and protection of horticultural plants; harvesting and storing their products.

146. **Home Floriculture and Flower Arrangement.** (1-0-3) Cr. 2. F.S.
Principles and methods of growing house plants and garden flowers and arrangement of cut flowers in the home.

154. **Greenhouse Methods.** (2 0-2) Cr. 3. W.
Principles and methods of plant growing under glass; nutritive solution culture of greenhouse plants.

164. **Vegetable Crops.** (2 0-0 or 2) Cr. 2 or 3. S.
A. (2-0-0) Cr. 2.; B. (2-0-2) Cr. 3.
Areas of production and culture of more important vegetable crops. Special emphasis on potatoes.

214. **Plant Propagation.** (0 2-3) Cr 3 W.
Prerequisite: 114 or Bot. 205.
Fundamental principles underlying sexual and asexual propagation of plants and practice in reproducing plants by use of seeds, leaves, stems, or roots.

224. **Grapes and Small Fruits.** (0-2-3) Cr. 3. S.
Prerequisite: 114.
Principles and practices involved in handling home and commercial plantings of vineyards and plantations of strawberries, bush fruits and miscellaneous small fruits.

244. **Garden Flowers.** (2-0-2) Cr. 3. S
Prerequisite: Bot. 101 or equivalent.
Description, nomenclature, classification, and culture of important garden flowers including annuals, perennials, bulbs, flowering vines, rock and water garden plants

314 **Turf Management.** (2-0 2) Cr. 3. Alt. years. Not offered 1953. S
Establishment and maintenance of turf for lawns, golf courses, athletic fields and playground areas Emphasis on soil, fertilizer, seedage and water requirements.

316 **Nursery Methods.** (0 2 2) Cr. 3. S.
Prerequisite: 214.
Equipment, including land, packing sheds, storage sheds, frames, glass houses, irrigation devices; large scale propagation; transplanting and management of plants; relations to other fields of horticulture; protection of nursery plants from climatic, disease, and insect difficulties.

324. **Grading and Judging Horticultural Products.** (0-0 4) Cr. 2 each time taken. F.
Prerequisite: 114 or equivalent.
Grading and judging horticultural crops and products; requirements of produce inspection services; rules and management of horticultural exhibitions.

344. **Commercial Floral Design.** (1 0 4) Cr. 3. Alt. W. Not offered 1953
Prerequisite: 154, 244.
Principles and methods of cut flower arrangement and design; interior decoration; exhibiting and judging flowers and plants. Open only to junior and senior students specializing in floriculture.

366. **Commercial Vegetable Crops.** (3-0 0) Cr. 3. W.
Prerequisite: 164.
Production of crops on commercial scale in truck farming and market gardening.

401, 402, 403. **Seminar.** (0-1-0) Cr. 1 each. Yr.

410. **Special Problems.** Cr. 2 to 6. Limit 6 credits. F.W.S.
Prerequisite: 21 credits in horticulture.

414. **Marketing Horticultural Products.** (2 0 2) Cr 3. Alt. W. Not offered 1953
Prerequisite: 114
Areas of production of horticultural crops, standardization, inspection, transportation, storage, price trends, agents of distribution, market news service, foreign markets, co-operative markets.

415. **Advanced General Horticulture.** Not open to horticulture majors. (0-3-0) Cr. 3. F.W
Prerequisite 114 or equivalent.
Application of scientific principles to horticultural techniques in selecting, propagating, planting, protecting, pruning, and growing horticultural plants.

421, 422. **Commercial Orcharding.** (0-2-2) Cr. 3 each. F.S
Prerequisite: 114.
Pomological regions, propagation, planting, varieties, culture, pest control, harvesting, grading, packing and storage.

424 **Exotic Fruits.** (2-0-0) Cr. 2. Alt. W. Offered 1953
Discussion of propagation, growing, shipping, and selling of tropical and subtropical fruits.

Courses for Advanced Undergraduate and Graduate Students

515 **History and Literature of Horticulture.** (3 0-0) Cr. 3. Alt. W. Offered 1953
Prerequisite: 21 credits in horticulture. Mr. Pickett
Origin of horticultural plants and practices. Prehistoric evidences of horticultural operations. Early historic references to arts of gardening. Greek and Roman authors Development of European and American literature of horticulture.

518. **Breeding of Horticultural Plants.** (2 0 3) Cr. 3 Alt. F. Not offered 1952
Prerequisite: Gen. 300. Mr. Lantz
Status; progress; application of principles of genetics to improvement of horticultural crops.

524. **Systematic Pomology.** (0-2-2) Cr. 3. Alt. F. Not offered 1952
Prerequisite: 114. Mr. Nichols
Description, nomenclature, and classification of native and subtropical fruits; critical descriptions and identifications, with special reference to relationships and classification of varieties.

534. 535. **Fruit and Vegetable Processing.** (3-0-0) Cr. 3 each.
Alt. W.S. Offered 1953
Prerequisite: Bact. 304, Chem. 256, and permission of instructor. Mr. Tischer
Methods used in the food industry to procure, process and market fruits and vegetables; factors of quality and their evaluation.

544. **Systematic Floriculture.** (2 0 2) Cr. 3. W.
Prerequisite: 154. Mr. Volz
Identification, classification, propagation, and culture of palms, ferns, orchids, begonias, and other greenhouse exotics.

546, 547. **Commercial Floriculture.** Mr. Volz
546. (2-0-2) Cr. 3. F.
Prerequisite: 154, 244.
Culture and propagation of florist bench crops and potted plants
547. (2-0-2) Cr. 3. Alt W. Offered 1953
Prerequisites: 546.
Culture of tender bedding plants; marketing cut flowers; organization and management of greenhouse and retail store.

564. **Canning Crops.** (3-0-0) Cr. 3. Alt. W. Offered 1953
Prerequisite: 114. Mr. Haber
Production of canning crops, study of seed strains, seed production, acreage contracts, grading.

565. **Systematic Olericulture.** (2 0 2) Cr. 3. Alt. F. Offered 1952
Prerequisite: 164. Mr. Haber
History and classification of vegetable species, groups, types and varieties, and development of classifications based upon relationships

Courses for Graduate Students

600. **Research.**
A Floriculture — Mr Volz
B. Pomology. — Messrs. Lantz, Pickett
C. Vegetable Crops. — Messrs. Erwin, Haber
D. Fruit and Vegetable Processing — Mr. Tischer
E. Propagation. — Messrs. Haber, Volz

603. **Experimental Horticulture.** (3 0 0) Cr. 3. Alt. W. Offered 1953
Mr. Haber
Organization, support, training, publication and relationship in horticultural research

604. **Graduate Conference.** Cr. 1 each time elected. F.W.S
Mr. Haber

Household Equipment

DEAN P. MABEL NELSON, Ph.D., Acting Head of Department

Professor. Louise Jenison Peet, Ph.D.

Associate Professors: Florence Anna Ehrenkranz, Ph.D . Faith M. Madden, M.S.

Instructors: Banister, Kohnke

Opportunities for Undergraduate Study

For undergraduate curriculum in household equipment leading to the degree of Bachelor of Science, see page 139.

The field of household equipment is one of the newer developments of home economics. Beginning as a general subject which aimed to give an understanding of the principles and techniques which the homemaker should know about the selection, operation, care and convenient arrangement of equipment in the house, it has grown to a curriculum preparing for both the professional and commercial fields. There is an increasing demand for trained women as home economics

directors in firms manufacturing household equipment; home service directors in gas and electric companies; research workers in college and commercial laboratories; college teachers; and extension workers.

Students interested in taking a combination course in household equipment and science should follow the curriculum on page 136.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science, and minor work to students taking major work in other departments. Work may be taken for the degree of Doctor of Philosophy as a divided major with departments offering work in related fields for this degree.

Prerequisite to major graduate work in household equipment is credit in beginning food courses, 12 quarter credits in physics (covering in detail mechanics, electricity, heat and light), 12 quarter credits in household equipment, and chemistry (general, organic, and quantitative methods). It is recommended that the student should have a general background in home economics, but students with fundamental training in chemistry, physics, and bacteriology may be accepted.

Students taking major work in household equipment will usually select their minors from economics, foods and nutrition, institution management, or physics.

Open to graduate students for minor only: 404, 405, 406, 422, 445.

Description of Courses

Courses Primarily for Undergraduate Students

154. Fundamentals of Household Equipment. (0-0-6) Cr. 3. F.W.S.
Prerequisite: Phys. 106 or equivalent.

404, 405, 406. Equipment Mechanics. (2 0 4) Cr. 3 each. Yr.
404. *Prerequisite:* 154, Phys. 106.
405. *Prerequisite:* 404.
406. *Prerequisite:* 405.
Fundamentals of electricity and heat. Simple circuits. Operation and use of laboratory testing and measuring instruments. Special problems.

414. Special Problems. Credit as arranged. F.W.S.
Prerequisite: 9 credits in advanced courses in household equipment.

421 Training in Demonstration Techniques. (2 0 4) Cr. 3. W.S.
A. For Household Equipment Majors.
Prerequisite: T Jl. 225B, Sp. 311, 6 credits in advanced household equipment.
B. For Nonmajors. S.
Prerequisite: Sp. 311, 6 credits in advanced courses in student's major department.
Practice in planning and giving demonstrations involving use of household appliances.

422. Home Service Organization and Management. (2-0 2) Cr. 3. S.
Prerequisite: 421A.
Problems and techniques in the organization and management of home service departments.

125. Seminar. (0 2-0) Cr. 2. F.W.
Prerequisite: 406.
Recent developments in equipment field.

445. Equipment Selection and Use. (2-0-2) Cr. 3. F.W.S.
Prerequisite: 154.
Efficient utilization of household equipment and storage space.

Courses for Advanced Undergraduate and Graduate Students

506. Gas and Electric Cooking Appliances. (2 0-4) Cr. 3. F.
Prerequisite: 406 Miss Ehrenkranz
Construction and efficient operation of ranges.

507. Equipment for Cleaning. (2-0 4) Cr. 3. Alt. S. Offered 1953
Prerequisite, 405, T.&C. 504 recommended. Mrs. Peet
Laundry equipment, vacuum cleaners, waxers, brushes.

508. Small Equipment. (2 0 4) Cr. 3. Alt. S. Not offered 1953
Prerequisite: 405. Mrs. Peet
Types on market, methods of manufacture, factors governing their efficiency.

509. Refrigeration and Home Lighting. (2 0-4) Cr. 3. W.
Prerequisite: Credit or classification in 405. Mrs. Peet
Construction and operation of ice and mechanical refrigerators; principles of electric circuits as applied to home wiring; lighting fixtures.

514. **Special Topics.** F.W.S.
Prerequisite: 405. Miss Ehrenkranz, Mrs. Peet

Courses for Graduate Students

604. **Seminar.** Credit as arranged. S.
Mrs. Peet

605. **Advanced Equipment Testing Technics.** (0-1-6) Cr. 3. W.
Prerequisite: 406, and 6 credits in household equipment 500 courses. Phys. 211, 212, 213. Miss Ehrenkranz
Theoretical principles involved in construction of testing apparatus, application of various types of testing apparatus, comparative results in using measuring instruments of different sensitivity.

610.* **Advanced Gas and Electric Range Testing.** (0-1-6) Cr. 3. F.
Prerequisite: 506, 605, F.&N. 511. Miss Ehrenkranz
Effect of steady and fluctuating temperatures, of differences in construction of ranges, etc., on food products.

611.* **Refrigeration Technology.** (0-1-6) Cr. 3. S.
Prerequisite: 509, 605, F.&N. 511 or 606. Mrs. Peet
Factors affecting temperature and humidity inside household refrigerators. Effects of temperature and humidity fluctuations on foods.

614. **Research.**
Miss Ehrenkranz, Mrs. Peet

618. **Experimentation With Household Equipment.** (0-1-6) Cr. 3. S.
Prerequisite: 506 or 509, 605; F.&N. 620 or Bact. 585, 586 or Chem. 514; F.&N. 606 or Bact. 631. Miss Ehrenkranz, Mrs. Peet
Effect of using certain household appliances on quality of food products as determined by physical, chemical, nutritional or bacteriological methods.

Hygiene

JOHN GRAY GRANT, M.D., Head of Department

Associate Professor: Lynn Dodge, M.D.

Assistant Professors: John Fremont Bacon, M.D.; Phoebe Theresa Goggin, M.D.; Gail Arlene McClure, M.D.; Sara B. Kalar Merryman, M.D.

Opportunities for Undergraduate Study

For the Student Health Service of the department, see page 70.

The purpose of this department is to conserve and improve the health of students while in college and to give them such training and instruction as will enable them to maintain high health standards for themselves and for the community, after leaving college.

Description of Courses

Courses Primarily for Undergraduate Students

204. **Health Education for Men.** (0-3-0) Cr. 3. F.
Health facts and practices.

404. **School Health Problems.** (3-0-0) Cr. 3. S.
Hygiene of school, health of school child and teacher, co-operating health agencies, and correlation of health education in curriculum.

Industrial Education

For description of courses, see Department of Vocational Education, page 325.

*When conditions are possible it is planned that the student shall spend two or three months in a range or refrigerator manufacturing plant to obtain first-hand technical knowledge of construction, operation, etc., of the given piece of equipment.

Institution Management

GRACE M. AUGUSTINE, Ph.D., Head of Department

Professor: Lenore Margaret Sullivan, M.S.

Associate Professor: Carolyn Cason, M.A.

Assistant Professors: Beatrice Donaldson, M A ; Marjorie Marie McKinley, M.A.

Instructors: Anderson, Guthrie, Hittle

Opportunities for Undergraduate Study

For undergraduate curriculum in institution management, leading to the degree of Bachelor of Science, see page 140

The curriculum in institution management is planned to prepare students for managerial positions in the fields of institution administration. Graduates of this department qualify for positions as dietitians or managers directing the food service in cafeterias, college dining halls, hospitals, industrial food units, restaurants, school lunchrooms, and tea rooms. Others manage food and housing departments of clubs, hotels and residence halls.

Training in large quantity food preparation and service is afforded through the Home Economics Tea Room. The Memorial Union and College Dining Halls offer managerial experience to advanced students through the food and room services.

It is suggested that students gain experience through practical employment during the summer vacation following the sophomore or junior year. An internship of six months to one year in an approved training course after completing this curriculum is recommended, though not required. A student is eligible for membership in the American Dietetic Association upon completion of a course approved by the Association.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science, and minor work to students taking major work in other departments.

Work may be taken for the degree of Doctor of Philosophy as a divided major with departments offering work in related fields for this degree.

Prerequisite to major graduate work is the completion of at least twenty-five quarter credits of undergraduate work in home economics, ten of which should be in institution management (large quantity cookery, purchasing, and equipment), and seven in foods and nutrition (nutrition and dietetics, and meal planning). Fundamental training in institution accounting, chemistry, physics, and bacteriology is required.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: 484, 485.

Description of Courses

Courses Primarily for Undergraduate Students

280. Group Food Service. (0-2-3) Cr. 3. F.S
Standard techniques and procedures of quantity food preparation demonstrated and practiced in the laboratory. Menu planning for camp, church, community and some residence groups, determining quantities of food to be purchased.

380. Large Quantity Cookery. (0-2-6 or 3) Cr. 3 or 4. F.W.S
Prerequisite: F.&N. 205.
Standard methods of food production in quantity; menu planning for institutions; food cost accounting; experience in food service. Advance reservation with head of department required.

484. **Purchasing.** (0-3-3) Cr. 4. F.W.
Prerequisite: 380 or F.&N. 303.
Principles and methods of buying food for various types of quantity food service, with emphasis on specifications and factors affecting quality.

485. **Equipment.** (0 3-3) Cr. 4. F.
Prerequisite: 380.
Selection and arrangement of equipment and furnishings for food departments with emphasis on materials, construction, and specifications.

Courses for Advanced Undergraduate and Graduate Students

580 **Experimental Quantity Cookery.** (0-1-6) Cr. 3. S.
Prerequisite: 380, F.&N. 511. Miss Sullivan
Methods in quantity food production as related to time factor, institution equipment, and proportions of ingredients.

585. **Catering.** (0-2-6) Cr. 4. F.W.S.
Prerequisite: 380, credit or classification in F.&N. 303. Miss Sullivan
Special food preparation and service for parties, dinners, and teas. Historical background of sectional foods in the United States and laboratory preparation of these and foreign foods.

586. **Institution Management Experience.** (1-0-6) Cr. 3. F.W.S.
Prerequisite: 380, 484, 485. Misses Anderson, Augustine
Experience in food service and housing departments of Memorial Union.

587 **Organization and Management.** (0-3-0) Cr. 3. W.S.
Prerequisite: 380 and credit or classification in 484. Misses Augustine, Donaldson
Organization of institution food departments, professional ethics and qualifications for managers, employment procedures, personnel schedules and financial records.

588. **Special Topics.** F.W.S.
Prerequisite: 484, 485. Credit as arranged. Misses Augustine, McKinley, Sullivan

589. **House Administration.** (0-2-3) Cr. 3. W.
Prerequisite: Credit or classification in 484. Miss Cason
Methods, procedures and operation of housekeeping departments in institutions.

Courses for Graduate Students

604. **Seminar.** Credit as arranged S.
Miss Augustine

606. **Institution Purchasing.** (0-1 6) Cr. 3 each.
Specifications, net yields and grading for quality; new developments in food products.
A Meats; Poultry. (A.H. 606A, P H. 606A). Messrs. Kastelic, Kline, Phillips
Prerequisite: 484, A.H. 374. S.
B Purchasing procedures; Dairy Products. Miss Sullivan, Mr. Mortensen
Prerequisite: 484. W.

607. **Institution Administration.** (0-3-0) Cr. 3. W.S.
Prerequisite: Permission of head of department. Miss Augustine
Job analysis, labor policies, labor organization, personnel problems, and financial control.

608 **Administration Problems.** (0 1 6) Cr. 3. F.W.S.
Prerequisite: 587. Miss Augustine
Solution of advanced administration problems through practice in College dining halls, Home Economics Tea Room and Memorial Union

614. **Research.**
Miss Augustine

Landscape Architecture

JOHN ROBERT FITZSIMMONS, M.L.A., Head of Department

Professor: Ralph Rudolph Rothacker, M.S.

Associate Professor: A. Maurice Hanson, B.S.

Assistant Professor: Margherita Tarr, B.S.

Instructor: Scannell

Opportunities for Undergraduate Study

For undergraduate curriculum in landscape arcihtecture leading to the degree of Bachelor of Science, see page 107.

The trained landscape architect adapts land areas to human service in urban regions and in the broad rural countryside. His relation to problems of the location of buildings and the treatment of their surroundings requires the consideration of architectural and engineering procedures. The materials he uses are mainly included within the fields of horticulture, forestry, geology, and civil engineering.

Professional practice of landscape architects includes the design, construction, planting, and maintenance of home grounds, estates, parks, cemeteries, school grounds, public and private institutions and subdivisions, towns and regional planning, including recreational landscape design, and other planning problems.

Students interested in the application of landscape planning to comprehensive and collaborative planning programs and projects, should consult with the head of the department or their counselor. See Comprehensive Planning Courses on page 110.

There are opportunities for competent professional men, both in private practice and in public employ as landscape architects, city planners, parks superintendents, and landscape recreational engineers for large reservations.

This department is accredited by the American Society of Landscape Architects and the American Institute of Planners and graduates are eligible for Junior Associate Membership in these organizations.

Students who wish to prepare for service as foremen of construction of planting, nursery landscape men, estate and park custodians, superintendents of institutional grounds and related positions should consult with the head of the department. A flexible two-year sequence will be arranged to fit the needs of the individual student.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Landscape Architecture and minor work to students taking major work in other departments. The degree of Master of Landscape Architecture is granted upon the completion of one year of satisfactory resident graduate work and the acceptance of a thesis after at least one full year of successful professional practice.

Students desiring to major in this department should present credits in landscape architecture substantially equivalent to those secured by undergraduate students in the curriculum in landscape architecture at this institution.

The department also offers major work for the degree of Master of Science, major in town and regional planning. Students should present the equivalent of the requirements of this institution for the degree of Bachelor of Science in one of the following departments: architecture, civil engineering, economics and sociology, or landscape architecture.

The following courses are open for major graduate credit to graduate students in town and regional planning: Arch. 600, 604; C.E. 574, 606, 690; Ec. 517, 540, 599A, 630, 699A; Soc. 585; L.A. 514, 515, 590, 600.

Open to graduate students for minor only: 334, 335, 401, 402, 403, 411, 412, 413, 436, 452, 466.

Description of Courses

Courses Primarily for Undergraduate Students

111. **Landscape Architecture Drawing.** (0-0-6) Cr. 2. F.
Prerequisite: Classification in E.Dr 131
Introduction to landscape architecture and the conventional drawing practices and methods of delineation.

112, 113. **Introduction to Landscape Design.**
112. (0-0-6) Cr. 2. W.
113. (1-0-6) Cr 3 S.
Prerequisite: 111.
Introductory problems in landscape design and presentation.

201, 202. **History of Landscape Architecture.** (2 1-0) Cr. 3 each. F.W.
Alt. Yr. Offered 1952-53
The development of landscape architecture from antiquity to modern times, with its relation to and influences of allied arts and professions. Lectures, readings, abstracts, and reports.

206. **Planning Home Landscapes.** (2-0-0) Cr. 2. F.W.S.
Understanding and enjoyment of native and humanized landscapes, with special attention to improvement of home and public grounds.

208. **Rural Landscape Design.** (2-0-3) Cr. 3. W.
Preparation of plans for farmsteads, small house lots, home and school grounds, and other public areas. Presented for agricultural engineering and horticultural students, as well as those interested in county agent work.

211, 212, 213 **Elements and Theory of Landscape Design.** (1-0-3) Cr 2 each. Yr
Prerequisite: 113.
Fundamental theory and principles of design brought out in the solution of simple problems.

231, 232. **Plant Materials.** W.S.
231. (1-1 3) Cr. 3. W.; 232. (1-0 6) Cr. 3. S.
(231) Introduction to study of plant materials as used in landscape architecture. Classification, nomenclature, requirements, sources, with winter twig identification. (232) Deciduous trees and shrubs with special emphasis on their seasonal landscape character and usage.

301, 302, 303. **Details of Construction.** (1 0 6) Cr. 3 each. Yr
Prerequisite: C.E. 218.
Theory and drafting room problems in landscape construction including grading, drainage and utility plans, estimates of cuts, fills, and cost data.

305. **Landscape Service.** (1 0-6) Cr. 3. S
Planting and maintenance operations and estimating practices, including handling of labor and equipment on landscape operations.

311, 312, 313. **Landscape Design.** (0-0-9) Cr. 3 each. Yr.
Prerequisite: 213.
Design of private and public properties based on actual topographies. Drafting, field work, reports, criticisms.

333. **Plant Materials.** (1-0-6) Cr. 3. F.
Prerequisite: 232.
Trees and shrubs, vines, evergreens, and herbaceous material. Field trips, leaf collection and reports.

334, 335. **Planting Design.** (1-0-6) Cr. 3 each. W.S.
Prerequisite: 311, 333.
Arrangement and use of plants in landscape and architectural design, with drafting and field practice.

341, 342. **Travel and Practice.**
341. Required Alt. S. Not offered 1953
342. Required. Alt. S. Offered 1953

350. **Community and Town Planning.** (2-1-0) Cr. 3. W.S.
Introductory analysis of problems and procedures in planning rural and urban communities with emphasis on official and citizen relationships.

401. **City or Town Planning.** (1-2-0) Cr. 3. F.
Functional city planning including fundamentals and historical development of civic design, with particular attention to the basic elements of city planning.

402. Planning and Zoning Administration. (2 1-0) Cr. 3. F.W.
Prerequisite: 401.
The planning process in operation; applications to local and regional problems.

408. Recreational and Regional Planning. (1-2-0) Cr. 3. S.
Prerequisite: 402, except for forestry students, or by special permission from head of department.
Basic land use patterns and recreational aspects of landscape architecture including local, state, and national parks, playgrounds, waterfronts, parkways, and public reservations.

404. Public Recreational Facilities. (2-1-0) Cr. 3. Alt. F. Offered 1952
Principles of design, construction and operation with special emphasis on national and state parks and forests.

411, 412, 413. Advanced Landscape Design. (0-0-12) Cr. 4 each. Yr.
Prerequisite: 313.
Design of public, semi-public, and large private properties.

436. Advanced Planting Composition and Design. (1-0-6) Cr. 3. F.
Prerequisite: 335.
Principles of design applied to the use of plants in various types of landscape problems.

441. Professional Procedure. (2-0-3) Cr. 3. Alt. S. Not offered 1953
Prerequisite: 311.
Office organization, forms, field operations, professional ethics, and public relations.

452. Site Planning. (2-1-0) Cr. 3. W.
Prerequisite: 313.
Functional design of public and semi-public institutional, housing and garden village sites and subdivision layouts.

466. Special Problems. F.W.S.
Prerequisite: 313, 333, quality point average of 2.5 or more for preceding two quarters.
Selected problems for balancing or completing individual student requirements.
Not to be taken if for substitution for design when registered for junior or senior design.

Courses for Advanced Undergraduate and Graduate Students

514. Collaborative Planning. (1-0-6) Cr. 3. W
Prerequisite: Permission of head of department. Mr. Fitzsimmons
Special problems in environmental physical planning

515. Special Planning Projects. (1-0-6) Cr. 3. F.W.S
Prerequisite: Permission of head of department. Mr. Fitzsimmons
Special planning projects assigned to three or more students having major work in different departments. Each student solving phases of problem related to his technical background in collaboration with other students.

590. Town and Regional Planning. Cr. 2 to 6 F.W.S
Prerequisite: Permission of instructor Mr Fitzsimmons
Special problems in environmental physical planning

Course for Graduate Students

600. Research. Mr Fitzsimmons

Library

ROBERT WILLIAM ORR, M.S., Head of Department

Professor: Charles Harvey Brown, M.A., B.L.S., Litt.D.

Associate Professor: Grant David Hanson, A.M.L.S.

Assistant Professors: John Patrick Coughlin, A.M.L.S , Ruth Sprecher Kristoffersen, B.S.; Grace Myrtle Oberheim, M.S.; E Frances Warner, B S ; Evelyn Georgiana Wimersberger, M.S

Instructors: Baker, Beck, Fritz, Fuller, Dorothy Havlik, Robert Havlik, Keltner, McHone, McNee, Peterson, Robbins, Shanley, Tucker, Verploeg

Opportunities for Undergraduate Study

Courses required of all freshmen are designed to increase facility in the use of books and the use of libraries.

Opportunities for Graduate Study

The library offers facilities for bibliographic research in the scientific and technical literature of the departments giving graduate instruction. The course "Bibliographic Research" (Library 614) may be taken for either major or minor credit in any department.

Description of Courses

Courses Primarily for Undergraduate Students

106. **Library Instruction.** (0-1-0) Required. F.W.S.
Use of books, library, and a survey of literature of major curricula.
A. For students in agriculture. Six weeks. F.
B. For students in home economics Six weeks. F.
C. For students in engineering. Six weeks. W.
D. For students in science. Six weeks of orientation course. (Sci. 101). F.

Course for Graduate Students

614 **Bibliographic Research.** (0-1-0) Cr. 1. F.W. SS.
Prerequisite: College degree. Mr. Orr
Lectures and practice on location of printed and manuscript materials and preparation of bibliographies on technical and scientific subjects.

Mathematics

DIO LEWIS HOLL, Ph.D., Head of Department

Professors: Edward Switzer Allen, Ph.D.; Ernest Willard Anderson, Ph.D.; Cornelius Gouwens, Ph.D.; Joseph Vance McKelvey, Ph.D.; Edwin Raymond Smith, Ph.D.; Henry Peter Thielman, Ph.D.; Gerhard Tintner, Ph.D.

Associate Professors: *Robert E. Gaskell, Ph.D.; Gertrude Anne Herr, M.S.; John James Luett Hinrichsen, Ph D.; *Clair George Maple, D Sc.; Pierre G. Robinson, Ph.D.; Bernard Vinograde, Ph D.

Assistant Professors: Henry D. Block, Ph.D.; Frank Edward Bortle, Ph.D.; Fred A. Brandner, M.S.; Marian Elizabeth Daniells, M.S.; Harris E. Dickey, M.S.; Ralph Wallace Johnson, M.A.; George E. Kaldenberg, M.S.; Orlando C. Kreider, Ph.D.; *Carl Eric Langenhop, Ph D.; Clarence H. Lindahl, M.S.; Fred Robertson, A.M., Helen Florene Smith, M.S.; Nelson Paul Yeardley, Ph.D.

Instructors: Benson, Brandstetter, Cargal, Conrad, Feyerherm, Klopfenstein, Lieberknecht, Mills, Robinson, Royer, Swartz

Opportunities for Undergraduate Study

For undergraduate curriculum in science, major in mathematics, leading to the degree of Bachelor of Science, see page 145.

The curriculum in science with a major in mathematics is quite flexible and is designed to prepare a student for one of the following positions: teacher of secondary school mathematics, assistant in commercial and industrial organizations, technician in insurance, actuarial, or engineering office.

Undergraduate majors in this department usually have included the following basic courses in their programs: 101, 102, 103, 211, 212, 213; 21 credits beyond 213, including at least two two-quarter sequences selected from 300-404; 314-315-316-527-528; 430-536-537; 451-452-454-455; 514-515; Stat. 341-342; differential equations should be included in any case. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of

*On leave

the work necessary for the major. They are given here solely for the convenience of students or counselors who wish to estimate the amount of basic, non-specialized study which may be needed.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in Mathematics and in fields of Applied Mathematics; minor work to students taking major work in other departments.

Students desiring to do graduate work with a major in this department should present at least fifteen quarter credits of work in mathematics beyond calculus. It is desirable that this should include differential equations and theory of equations.

Minor work is usually required in physics, chemistry, engineering, statistics, or certain phases of agriculture.

Open to graduate students for minor only: 300, 314, 315, 316, 404, 418, 430, 451, 452, 453, 454, 455, 494.

Description of Courses

Course for Noncollegiate Students

5. Advanced Algebra. (0-5-0) Cr. 5. SS.
Prerequisite: One year of high school algebra.
Satisfies requirements for third half-unit of entrance algebra.

Courses Primarily for Undergraduate Students

101, 101X. College Algebra.
101. (0-5-0) Cr. 5. F.W.S.
Prerequisite: One and one-half units of high school algebra.
101X. (0-8-0) Cr. 8. F.W.
Prerequisite: Two units of high school algebra.
Review of high school algebra, systems of equations, logarithms, variation, binomial theorem, progressions, theory of equations, annuities, partial fractions.

102. Plane Trigonometry. (0-4 or 5-0) Cr. 4 or 5. F.W.S.
Prerequisite: 101.
A. For students in science, forestry and landscape architecture. (0-5-0) Cr. 5.
C. For students in engineering. (0-4-0) Cr. 4. Credit or classification in Gen.E. 105 required.
X. For students in engineering having high school credit in trigonometry. (0-2-0) Cr. 2.
Functions of general angles, general identities, graphs, solutions of right and oblique triangles with applications.

108. Analytical Geometry. (0-5-0) Cr. 5. F.W.S.
Prerequisite: 101, 102.
Engineering students classify in Gen E. 106.
Co-ordinate systems, graphs, equations of loci, straight lines, conics, special curves, transformations, quadric surfaces, applications.

112, 113. Mathematical Analysis. (0 5-0) Cr. 5 each. W.S.
Prerequisite: 101.
112. Functions, graphs, rates, tangents, areas, limit processes, logarithmic graphs and functions; differentiation and integration of polynominal, logarithmic and exponential functions.
113. Permutations, combinations, determinants, curve fitting by application of calculus of least squares and moments, probability, frequency distributions and graphs, normal and "t" distributions, averages, dispersion, correlation and tests.

148. Elements of Analytical Geometry and Statistics. (0-3-0) Cr. 3. S.
Prerequisite: 102.
Rectangular coordinates, the straight line and parabola. Estimation of statistical parameters from samples, simple distributions, tests of significance. Alignment charts, empirical equations. Applications to problems in forest mensuration.

200. General Mathematics for Students of Home Economics. (0-5-0) Cr. 5. S.
Prerequisite: One unit of high school algebra.
Linear, quadratic, exponential, and trigonometric functions; introduction to calculus.

205. Mathematics for Students of Agriculture. (0-4 0) Cr. 4. F.W.S.
Prerequisite: One unit high school algebra.
Graphical methods, simple equations, exponents and radicals, logarithms, numerical trigonometry, progressions, interest and annuities, application to agriculture.

206. Mathematical Theory of Investments. (0-5-0) Cr. 5. S.
Prerequisite: 101
Interest, annuities, sinking funds, building and loan associations, bonds, use of tables.

211, 212, 213. Calculus. F.W.S. each
Prerequisite: 103.
(211) Differential and integral calculus I. (0-5-0) Cr. 5. (212) Differential and integral calculus II. (0-4-0) Cr. 4. (213) Differential and integral calculus III. (0-4-0) Cr. 4.

241, 242, 243. General Mathematics and Statistics. (1-3-0) Cr. 4 each. Yr.
Prerequisite: One and one-half units of high school algebra, credit or classification in a course in economics.
Linear, quadratic, exponential, and logarithmic functions, calculus of simple functions, progressions, interest and annuities, permutations and combinations, probability, curve fitting, averages, dispersion, correlation, periodicity, index numbers.

300. Theory of Equations. (0-3-0) Cr. 3. S.
Prerequisite: 212.
Complex numbers, exact and approximate solution of polynomial equations, symmetric functions, systems of equations, determinants.

307. Mathematics of Life Insurance. (0-3-0) Cr. 3. W.
Prerequisite: 101.
Probability, mortality tables, life insurance, life annuities, endowments, computation of net premiums, evaluation of policies, construction and use of tables.

310. Mathematics of Navigation. (0-3-0) Cr. 3. W.
Prerequisite: 102.
Maps, use of charts, course plotting, right and oblique spherical triangles; applications to terrestrial and celestial spheres; nautical astronomy and navigation.

314, 315. Differential Equations. (0-3-0) Cr. 3 each. F.W.S.
Prerequisite: 213.
314. Formulation of practical problems as solutions of differential equations; methods of solving type forms.
315. Singular solutions, total differential equations in more than two variables, systems of equations, solution by series, methods of approximation, introduction to partial differentiation and Fourier series.

316. Advanced Mathematics for Electrical Engineers. (0-5-0) Cr. 5. F.W.
Prerequisite: 213, and credit or classification in E.E. 301.
Differential equations of electrical engineering, determinants and matrices, Fourier series, elementary vector analysis, and topics useful in electrical engineering.

341, 342. Introduction to Theory of Statistics. (Stat. 341, 342) See Statistics.

404. Intermediate Algebra. (0-3-0) Cr. 3. F.
Prerequisite: 213.
Multinomial theorem, finite differences, inequalities; introduction to the theory of matrices.

418. Elementary Operational Mathematics. (0-3-0) Cr. 3. W.
Prerequisite: 314 or 316.
Laplace transform and its properties. Applications to ordinary and partial differential equations; with special reference to electrical circuits, mechanical vibrations, automatic control problems, heat conduction.

430. Solid Analytical Geometry. (0-3-0) Cr. 3. F.
Prerequisite: 213, 300.
Analytical geometry of three dimensions. Particular emphasis on surfaces of the second degree.

437. Mathematical Analysis. (Ec. 437) See Economics.

451, 452, 453. Advanced Mathematics in Engineering. (0-3-0) Cr. 3 each. Yr.
Prerequisite: 314 or 316.
Selected topics in applied mathematics, including differential equations, hyperbolic functions, elliptic integrals, matrices and determinants, expansion in series. Fourier series, Gamma and Bessel functions, vector analysis, probability, functions of complex variable and dimensional analysis; applications in solution of technical problems.

454, 455. Analytical Mechanics. (Phys. 454, 455) (0-3-0) Cr. 3 each. F.W.
Prerequisite: 314, Physics 213 or 223.
Particle dynamics, simple harmonic motion, central forces; statics and dynamics of rigid bodies. Lagrange equations.

490. History of Mathematics. (0-3-0) Cr. 3. Alt. S. Not offered 1953
Prerequisite: 212, senior college classification.
Source of mathematical principles, growth of mathematical knowledge, contributions of outstanding mathematicians.

494. Foundations of Mathematics. (0-3-0) Cr. 3. Alt. S. Offered 1953
Prerequisite: 6 credits beyond 213, permission of instructor.
Sets, equivalence, transfinite numbers; postulational systems in geometry, algebra, analysis; other basic topics in mathematics.

497. Teaching of Secondary School Mathematics. (0-3-0) Cr. 3. W.
Prerequisite: 15 credits in college mathematics.
Organization of subject matter, methods of presenting particular topics, evaluation of results.

Courses for Advanced Undergraduate and Graduate Students

507. **Numerical Analysis.** (0-3-0) Cr. 3. S.
Prerequisite: 314 or 316. Mr. Gaskell
Numerical solution of algebraic equations, Newton's method and its generalizations. Solution of differential equations by the methods of Adams, Runge-Kutta, Milne. The relaxation method.

514, 515. **Advanced Calculus.** (0-3-0) Cr. 3 each. F.W.
Prerequisite: 213. Mr. Thielman
Partial differentiation and applications; multiple, line, surface, and Stieltjes integrals; indeterminate forms, infinite series and improper integrals.

516. **Definite Integrals.** (0-3-0) Cr. 3. S.
Prerequisite: 213. Mr. Gouwens
Important integrals which appear in applied mathematics, including elliptic type.

518. **Operational Mathematics.** (0-3-0) Cr. 3. S.
Prerequisite: 514. Mr. Gaskell
Use of complex variable theory in deriving properties of the Laplace transform. Applications to partial differential equations, Sturm-Liouville systems. Fourier and Hankel transforms. Verification of solutions and uniqueness proofs.

520. **Boundary Value Problems.** (0-3-0) Cr. 3. W.
Prerequisite: 514. Mr. Gaskell
Expansions in orthogonal functions, and their use in solving boundary value problems. Verification and uniqueness of solutions. Bessel functions and Legendre polynomials and their applications.

524. **Infinite Processes.** (0-3-0) Cr. 3. S.
Prerequisite: 213, permission of instructor. Mr. Hinrichsen
Fundamental concepts and propositions of infinite processes. Infinite sequences, series, products, continued fractions, determinants and integrals.

527, 528. **Advanced Differential Equations.** (0-3-0) Cr. 3 each. Alt. W.S. Offered 1953
Prerequisite: 315 and 515. Mr. Hinrichsen
Existence theorems, normal forms, properties of solutions, adjoint systems, Wronskians, separation and oscillation theorems, Sturm-Liouville systems, Green's functions, asymptotic solutions.

536, 537. **Introduction to Projective Geometry.** (0-3-0) Cr. 3 each. W.S.
Prerequisite: 213 and permission of instructor. Mr. Robinson
Synthetic and analytic methods in projective geometry.

541, 542, 543. **Theory of Statistics.** (Stat. 541, 542, 543) See Statistics.

550. **Vector Analysis.** (Phys. 550) (0-4-0) Cr. 4. S.
Prerequisite: 314 or 316 Mr. Langenhop
Fundamental operations on vectors, potential functions, gradient, divergence, and curl, applications in physics and mechanics.

551, 552, 553. **Introduction to Theoretical Physics.** (Phys. 551, 552, 553.) See Physics.

556. **Tensor Analysis.** (0-3-0) Cr. 3. W.
Prerequisite: 514, 550. Mr. Allen
Tensor and vector fields; properties of symmetric and anti-symmetric tensors; tensor densities, reduction, parallelism, Christoffel symbols, covariant differentiation; metric spaces, geodesic coordinates, curvature, and applications.

599. **Special Topics.** F.W.S.
Messrs. Allen, Anderson, Block, Gaskell, Gouwens, Hinrichsen, Holl, Langenhop, Maple, McKelvey, Robinson, Smith, Thielman, Tintner, Vinograde

Courses for Graduate Students

600. **Finite Groups.** (3-0-0) Cr. 3. Alt. S. Offered 1953
Prerequisite: 300, permission of instructor. Mr. Allen
Galois theory of equations, group representations, physical applications.

604, 605. **Higher Algebra.** (3-0-0) Cr. 3 each. W.S.
Prerequisite: 404, permission of instructor. Mr. Vinograde
Fields and vector spaces, matrices and their canonical forms, orthogonal and other important transformation groups, forms and their invariants, topics in abstract algebra.

610. **Seminar.**
Messrs. Allen, Anderson, Block, Gaskell, Gouwens, Hinrichsen, Holl, Langenhop, Maple, McKelvey, Robinson, Smith, Theilman, Tintner, Vinograde

611, 612. **Functions of a Complex Variable.** (3-0-0) Cr. 3 each. F.W.
Prerequisite: 315, permission of instructor. Mr. Hinrichsen
Functions of complex variable, continuity, differentiability, integrability, conformal mapping, calculus of residues, applications.

614, 615. **Functions of Real Variables.** (3-0-0) Cr. 3 each. W.S.
Prerequisite: 515 or permission of instructor. Mr. Thielman
614. Real continuum, basic concepts in theory of real functions, theory of point-sets, transfinite numbers. 615. Measure, Riemann, Lebesgue and other integrals, abstract spaces.

616, 617. **Probability.** (Stat. 616, 617) (3-0-0) Cr. 3 each. Alt. S. SS. Offered 1953
Prerequisite: 515, or permission of instructor. Mr. Allen
(616) Fundamental concepts, theory of errors, probabilities of hypotheses, characteristic functions, geometrical and physical applications; (617) axiomatic bases, laws of large numbers, extension to infinite dimensions, asymptotic laws, ergodic theory.

620. **Calculus of Variations.** (3-0-0) Cr. 3. S.
Prerequisite: 612. Mr. Gouwens
The differential equations of a curve which minimizes a definite integral in space of two or more dimensions. Properties of a minimizing curve as deduced by Legendre, Weierstrass and Jacobi. Conditions which insure the existence of a minimum. Examples illustrating the various types of problems.

621, 622, 623. **Differential Equations of Mathematical Physics.** (3-0-0) Cr. 3 each. Alt. Yr. Not offered 1952-53
Prerequisite: 315, 612. Phys. 213. Mr. Maple
Derivation and solution of equations governing various physical phenomena, study of Bessel's functions, polynomials, orthogonal functions and expansions, potential theory, and advanced problems arising from differential equations.

626, 627. **Integral Equations.** (3 0 0) Cr 3 each. Alt W S Offered 1953
Prerequisite: 612. Mr. Thielman
Linear integral equations, applications to physics and biology.

632, 633. **Metric Differential Geometry.** (3-0 0) Cr. 3 each. Alt. F.W. Offered 1952-53
Prerequisite: 515
Application of the calculus to the metric theory of space curves and surfaces; system of curves, geodesics, ruled surfaces, minimal surfaces and intrinsic properties

636. **Topology.** (3 0 0) Cr 3 Alt. Yr. Not offered 1952 53
Prerequisite: 515 and permission of instructor. Messrs. Thielman, Vinograde
Topological and metric spaces, introduction to combinatorial topology.

637. **Introduction to Hilbert Space and Functional Analysis.** (3-0-0) Cr. 3.
Alt. S. Not offered 1953
Prerequisite: 614 or 636 Mr. Block
Linear operators on concrete and abstract Hilbert spaces; spectral resolution; applications to quantum mechanics, Fourier analysis, integral equations and boundary value problems operators on Banach spaces

641, 642, 643 **Advanced Theory of Statistics.** (Stats. 641, 642, 643) See Statistics

645. **Econometrics.** (Ec. 645) See Economics.

646 **Time Series.** (Ec 646, Stat. 646) See Statistics.

647. **Multivariate Analysis.** (Stat. 647) See Statistics.

648 **Sequential Analysis.** (Stat 648) See Statistics.

654, 655. **Dynamics.** (Phys. 654, 655) (3-0 0) Cr. 3 each. W.S
Prerequisite: 315 or 316 Physics 423 Mr. Block
Vector methods in dynamics; free and forced motion of systems; normal co-ordinates; Lagrange and canonical equations; contact transformations; Hamilton-Jacobi equations; orbital theory and celestial mechanics; integration theories of dynamics.

656, 657. **Mathematical Theory of Hydrodynamics.** (3 0 0) Cr 3 each.
Alt W.S. Offered 1953
Prerequisite: 515, 550, permission of instructor
Hydrodynamics of incompressible ideal and viscous fluids, with emphasis on two dimensional flows; compressible fluids and shock phenomena

658, 659. **Non-Linear Differential Equations.** (3 0 0) Cr. 3 each.
Alt W S Offered 1953
Prerequisite: 315, 514 Mr. Langenhop
General methods for studying non-linear differential equations, with examples from mechanics and electrical circuits; analytical methods of Poincaire, van der Pol, Kryloff; oscillations.

661, 662, 663. **Mathematics of Elasticity.** (T.&A.M. 661, 662, 663)
(3-0-0) Cr. 3 each. Alt. Yr. Offered 1952 53
Prerequisite: 315, permission of instructor. Mr. Holl
Two-dimensional problems of plane stress, plane strain; torsion and flexure; general stress-strain analysis in three dimensions; variational methods; plasticity.

666, 667, 668. **Static and Dynamic Problems of Plates and Shells.**
(T.&A M. 666, 667, 668) (3-0-0) Cr. 3 each. Alt. Yr Not offered 1952-53
Prerequisite: 315, permission of instructor. Mr. Holl
Thin plate analysis; three-dimensional plate problems; shells, stability and vibration of plates and shells.

674, 675. **Mathematical Theory of Relativity.** (3 0 0) Cr. 3 each. Alt. W.S.
Not offered 1953
Prerequisite: 515. Mr Allen
Restricted and general theories tensor density analysis, cosmological problems.

681, 682, 683. **Quantum Mechanics.** (Phys 681, 682, 683) See Physics.

688. **Seminar on the Theory of Statistics.** (Stat. 688) See Statistics.

699. **Research.** Messrs. Allen, Anderson Block, Gaskell Gouwens, Hinrichson, Holl, Langenhop, Maple, McKelvey, Robinson, Smith, Tintner, Vinograde

Mechanical Engineering

HENRY MONTGOMERY BLACK, S.M., Head of Department

Professors: Mark Perkins Cleghorn, M.E.; Earl Downing Hay, M.E.; Lambert Sigfred Linderoth, Jr., M.E.; Henry L. Mason, D.Sc.; Herman J. Stoever, Ph.D.

Associate Professors: W. Chester Fitch, Ph.D.; Howard B. Holroyd, Ph.D.; Jesse Greenville Hummel, M.E.; Roy Everett Roudebush, M. E.; John Frederick Sandfort, M.S.

Assistant Professors: Robert William Breckenridge, M.S.; Robert Cecil Fellinger, M.S.; Eugene Shallcross Ferguson, B.S.; Ralph L. Freeman, M.S.; Marvin Earl Gould, B.S.; Henry Francis Hrubecky, M.S.; John Hug, M.E.; Edward William Jerger, Ph.D ; *Jordan Louis Larson, M.S.; *John W. McKiernan, M.S.; *Hal W. Maynor, M S.; *Freeland Frank Stecker, M.S.; *James Leroy Threlkeld, M.S.

Instructors: Gesser, Maitland, Reinholz

Opportunities for Undergraduate Study

For undergraduate curriculum in mechanical engineering leading to the degree of Bachelor of Science, see page 124.

The professional services performed by mechanical engineers vary from the highly scientific work of research and development through the applied work of design and production, to the management, operation, and sales activities of industry. These services are rendered in fields ranging from the conversion and utilization of heat, to the development and design of machines, and the manufacture of commodities.

The curriculum includes, in addition to the fundamental sciences of mathematics, chemistry, and physics, a well-balanced series of courses in metallurgy, machine design, fundamental thermodynamics and heat, and applied thermodynamics Opportunity is offered for limited specialization in mechanics and design; in steam power equipment; internal combustion engines; heating, ventilation, and air conditioning; electronics applications, industrial and manufacturing; mathematics or physics.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in mechanical engineering, and minor work to students taking major work in other departments. Work may be taken for the degree of Doctor of Philosophy as a divided major with departments offering work in related fields for this degree.

Students desiring to major in this department should have completed an undergraduate curriculum equivalent to that required of undergraduate students in mechanical engineering at this institution.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: 310, 312, 315, 321, 322, 325, 342, 423, 426, 427, 429, 435, 440, 444, 445, 448, 455, 467, 480.

*On leave

Description of Courses

Courses Primarily for Undergraduate Students

100. Technical Lecture. (1-0-0) Required. S.
Field of mechanical engineering, its opportunities and requirements.

201. Machine Shop. (0-0-6) Cr. 2. F.W.S.
Principles and practice of machine tool and bench working of metals. Machining of steel, cast iron, and non-ferrous metals.

202. Metal Casting. (0-0-6) Cr. 2. F.W.S.
Processes and equipment employed in molding and casting of ferrous and non-ferrous metals.

204. Metal Fabrication. (0 0 6) Cr. 2. F.W.S.
Gas and electric welding. Study of pipe, pipe joints and fittings. Sheet metal construction.

206. Machine Shop. (0 0-6) Cr. 2. W.
For Industrial Education Majors.
Lathe work.

207. Machine Shop. (0-0 6) Cr. 2. S.
For Industrial Education Majors.
Milling machine, shaper, grinder, drill press, bench work.

211, 212, 213. Physical Metallurgy. Yr.
211. (0-3-0) 212, 213. (0-2-3) Cr. 3 each.
Prerequisite: Chem. 103.
Basic principles of metallography; scientific production control of melting, casting, fabrication, heat treating, and welding processes.
Specifications, uses, physical testing, and inspection of industrial metals and alloys.

305. Tool Engineering. (0 1-6) Cr. 3. S.
Prerequisite: 201 and 204.
Design and application of special tools, jigs, and fixtures

310. Kinematics. (0-3-3) Cr. 4. F.W.
Prerequisite: Credit or classification in T&A.M. 344.
Analysis of displacements, velocities, and accelerations in machines. Study of cams, gears, belts, and miscellaneous mechanisms.

312. Machine Analysis. (0-3-3) Cr. 4 W.S.
Prerequisite: 310, classification or credit in T.&A.M. 324.
Analysis of static and dynamic stresses in machine members. Force analysis in complete machines. Dynamics of machinery.

315. Design of Machine Elements. (0-3-3) Cr. 4. F.S.
Prerequisite: 312.
Design of fastenings, pressure vessels, shafts, gearing, belting, clutches. Bearings and lubrication.

321, 322. Thermodynamics. (0 4-0) Cr. 4 each F.W.S.
321. *Prerequisite:* Phys. 222, T.&A.M. 274.
322. *Prerequisite.* 321, classification in 342
Properties and fundamental equations of gases and vapors. Thermodynamics of heat cycles, compressors, and engines.

325. Heat Transfer. (0 3-0) Cr. 3. F.S.
Prerequisite: 321 or 344, Math. 314.
Solution of practical engineering problems involving transfer of heat by conduction, radiation, and convection.

342. Thermodynamics Laboratory. (0 0-3) Cr. 1. W.S.
Prerequisite: Classification in 322.

343. Mechanical Laboratory. (0-0-3) Cr. 1. F.S.
Prerequisite: 342.

344. Thermodynamics. (0-4-3) Cr. 5. F.W.S.
Prerequisite: Math. 213, Phys. 222.
Properties and fundamental equations of gases and vapors. Thermodynamics of heat cycles, compressors, and engines.

400. Inspection Trip. Required. F.
Prerequisite: Senior M.E. classification.
Inspection trip to industrial centers.

423. Machine Design. (0-2-6) Cr. 4. F.W.
Prerequisite: 315.
Projects in design of complete machines.

426. Refrigeration and Air Conditioning. (0-3 3) Cr 4. F.W.S.
Prerequisite: 322 or 344, 325.
Principles of refrigeration; analysis of refrigeration cycles. Principles of air conditioning with emphasis on thermodynamic processes involving air-water vapor mixtures.

427. **Heating and Air Conditioning Design.** (0-2-6) Cr. 4. W.S.
Prerequisite: 426.
Design and layout of heating, ventilation, and air conditioning systems.

429. **Internal Combustion Engine Design.** (0-2-6) Cr. 4. W.S
Prerequisite: 445.
Design and layout of a high-speed internal combustion engine of carburetion or Diesel type.

432 **Heating and Ventilation.** (0-3-6) Cr. 5. W
Prerequisite: Arch. 306.
Principles of heating and ventilation as applied to residences, public and industrial buildings. Design and layout of heating and ventilation systems.

435. **Industrial Metallurgy.** (0-3-0) Cr. 3. F.S.
Prerequisite: 213.
Mechanical and thermal problems in processing of industrial metals. Selection and application of alloy and special purpose steels.

440. **Fuels and Combustion.** (0-3-3) Cr. 4. F.S.
Prerequisite: 322 or 344.
Composition, properties, and combustion of fuels; fuel and flue gas testing.

443. **Heat Engines.** (0-2-3) Cr. 3. W
Prerequisite: 344.
Operating characteristics and performance of steam engines, turbines, internal combustion engines, and auxiliary equipment.

444. **Steam Power Equipment.** (0-3-3) Cr. 4. F.W.S.
Prerequisite: 325, 343, 440 and T.&A.M. 378.
Thermodynamics and performance of steam boilers, engines, turbines, and gas compressors. Reheating, regenerative, and binary cycles.

445 **Internal Combustion Engines.** (0-3-3) Cr. 4. F.W.S.
Prerequisite: 440.
General principles, thermodynamics, and performance of carburetion and fuel-injection engines. Characteristics of fuels.

448. **Steam Power Plant Design.** (0-2-6) Cr. 4. W.S.
Prerequisite: 440, 444.
Principal and auxiliary equipment for power, heating, and pumping plants. Cooling towers, boiler water treatment, principles of plant design.

450 **Airplane Engines.** (0-2-6) Cr. 4. S
Prerequisite: 445.
Engine types: structural details; carburetion, ignition, cooling, and super-charging systems. Layout and design of specific types

455 **Motion and Time Study.** (0-1-3) Cr. 2. W.S.
Prerequisite: Gen E. 351.
Principles and methods of motion and time study as employed in industrial operations.

456. **Power Generation.** (0-3-3) Cr. 4. S
Prerequisite: 344.
Fuels and combustion. Boilers, turbines, condensers and auxiliary steam power plant equipment. Internal combustion engines.

467. **Diesel Engines.** (0-3-0) Cr. 3. F.S.
Prerequisite: 445.
Detailed study of Diesel engine including principles of operation, performance, fuels, and applications. Costs of power production.

480. **Engineering Contracts.** (0-3-0) Cr. 3 F.W.S.
Prerequisite: Senior college classification and credit or classification in Ec. 262.
Engineer in business; contract essentials and principles; agent and independent contractor; contracts involving real and personal property, sale, and transportation; corporation engineering; legal and equitable jurisprudence.

487. **Special Problems.** Cr. 3 to 5. F.W.S.
Prerequisite: Senior classification.
Investigation on topic holding special interest of student. Comprehensive report required. Election of course and topic must be approved by head of department.

490. **Mechanical Equipment of Buildings.** (0-3-0) Cr. 3. S.
Prerequisite: Senior classification and 432.
Water supply, storage and treating equipment for building service. Design of piping systems in buildings including water supply and drainage systems. Study and application of miscellaneous mechanical equipment for buildings.

Courses for Advanced Undergraduate and Graduate Students

501. **Engineering Measurement.** (0-3-0) Cr. 3. W.
Prerequisite: Permission of head of department Mr. Mason
Measurement of quantitative characteristics when the principal independent variables are under positive control Rational and empirical techniques in relation to planning, execution and interpretation of experiments

513. **Lubrication.** (0-4-0) Cr. 4. S.
Prerequisites: 423, Math. 314, T.&A.M. 378. Mr. Linderoth
Theories and applications.

515. **Advanced Design of Machine Elements.** (0-4-0) Cr. 4. W.
Prerequisite: T.&A.M. 514 Mr. Linderoth
Rational approach. Correlation of rational and empirical formulae.

531. **Advanced Physical Metallurgy.** (0-4 0) Cr. 4. F.
Prerequisite: Permission of head of department. Messrs. Freeman, Maynor
Principles; structure of metals and alloys, solid state reactions; mechanical behavior of metals.

532. **Principles of Heat Treatment of Steel.** (0-3 3) Cr. 4. W.
Prerequisite: Permission of head of department. Mr. Freeman
Terminology, testing, heat treatment below critical range, transformation of austenite.

533. **Heat Treatment and Selection of Steels.** (0 4-0) Cr. 4. S.
Prerequisite: 532. Mr Freeman
Tools, processes and control. Applications of principles of 532

587. **Special Topics.** Cr. 3 to 5. F.W S
Mr. Black
Investigation of problems of special interest to the student Comprehensive report required. Election of course and topic must be approved by head of the department

Courses for Graduate Students

600. **Advanced Machine Design.** Cr. 3 to 5 F.W.S.
Mr. Hay
Mathematical and experimental analysis of problems in field of dynamics of machinery, stress analysis, and vibration. Choice of work any quarter determined by aptitudes and interests of class.

610. **Dynamics of Automatic Control Systems.** Cr. 3 or 5 S
Mr. Mason
Dynamical characteristics of the elements for measurements and automatic control of variables in mechanical, thermal and fluid systems and devices.

620. **Seminar.** (1 0-0) Cr. 1 Messrs. Black, Stoever

640. **Industrial Heating and Air Conditioning.** Cr. 3 to 5. F
Mr Black
Theory and practice of plant and industrial heating, ventilation, and air conditioning.

645. **Advanced Engineering Thermodynamics.** Cr. 4 to 8. F.W.
Mr. Stoever
Fundamental concepts of thermodynamics, thermodynamic laws, temperature, entropy, thermodynamic equations, properties of steam, fluid flow, mixtures, combustion, special topics.

646. **Heat Transfer.** Cr. 3 to 5. S.
Mr. Stoever
Solution of practical engineering problems involving transfer of heat by conduction, radiation, and convection.

647. **Internal Combustion Engines.** Cr. 3 to 5. W.
Mr. Black
Advanced thermodynamics, combustion and design problems of the internal combustion engine. Special studies in fuels.

655. **Research.**
Messrs. Black, Cleghorn, Hummel, Mason, Roudebush, Stoever

678. **Central Stations.** Cr. 3 to 5. S.
Messrs. Cleghorn, Hummel
Location and types; choice and arrangement of apparatus; coal conveying and storage systems Power costs.

Military Science, Naval Science, and Air Science and Tactics

HAROLD V. GASKILL, Ph.D., Head of Department

COURSES IN MILITARY SCIENCE

Professor of Military Science and Tactics, Col. Glenn B. McConnell, B.S.

Associate Professors: Lt. Col. Alpheus H. Seeley, D.V.M.; Maj. James H. Harper, B.S.; Maj. Robert E. Dunlap, B.S.; Capt. James E. Smith, B.S.

Assistant Professors: Maj. William L. Holcomb, B.S.; Capt. Michael J. McCarthy, B.S.; Capt. Raymond A. Gulley, B.S.; Capt. Dwight X. Wilmeth, B.S.; Capt. John C. Brennan, B.S.; Capt. James M. Dill, B.S.

Instructors: M/Sgt. Biggs, M/Sgt. Douglas, M/Sgt. Kerr, M/Sgt. Latham, M/Sgt. Colemen, SFC Adams, SFC Cary, SFC Porter, SFC Prusinski

Since the establishment of our national government, reliance has been placed upon citizen armies for defense, rather than upon a large standing army of professional soldiers. It is part of the American tradition that citizenship carries with it certain obligations as well as privileges. In conformity with this tradition, the National Defense Act of 1920 provided for only a small Regular Army and National Guard, and set up a skeleton organization upon which a citizen army could be built in time of need. One of the most important elements in this framework consists of a corps of reserve officers trained in our colleges and universities. The Reserve Officers Training Corps provides the organization for training these future officers.

As a result of operation of the Reserve Officers Training Corps, the United States had immediately available at the outset of World War II over one hundred thousand reserve officers who required only a short period of specialized training to fit them for active duty. They were of inestimable value to the nation in speeding up the mobilization and training of our vast citizen army, and as leaders in combat.

The four-year course is conducted by regular army and selected officers of the Officers Reserve Corps, with equipment furnished by the United States Government, and consists of a one-year basic course providing training in military subjects common to all branches of the Army, a second year basic course, and two years advanced course providing training in the duties of a junior officer with emphasis on branch specialization.

Since the school year 1946-47, the Reserve Officers Training Corps courses have been reinstated on a full scale basis, with a new program of instruction embracing the latest tactics and technique of our military science. The prerequisite basic course for enrollment in the advanced course is waived for veterans who have had extended military service.

Iowa State College requires all physically fit male undergraduate students not over 23 years of age at the time of their first registration to complete Military Science I and II before graduation unless otherwise excused. Students who do not classify in Military Science because of the age limitation are excused from the requirements in physical education.

Description of Courses

Courses Primarily for Undergraduate Students

Basic Course, Senior Division ROTC

111, 112, 113. Military Science I. (0-1-2) Cr. 1 each. Yr.
Military fundamentals; organization; policy; individual weapons and marksmanship; maps and aerial photography; first aid; leadership

Courses in Engineer Unit

201, 202, 203. **Military Science II.** (0-1-2) Cr. 1 each. Yr.
Prerequisite: 113 or service in the armed forces, or three years service in a federally recognized Junior ROTC and classification in Division of Engineering.
Leadership; characteristics of weapons; camouflage; explosives and demolitions; rigging; mines and booby traps; field fortifications; tactics.

301, 302, 303. **Military Science III.** (0-3-2) Cr. 3 each. Yr.
Prerequisite: 203, or extended services in armed forces.
Leadership; bridge design and classification; signal communications; intelligence; military roads and runways; water supply; tactics; weapons and marksmanship.

401, 402, 403. **Military Science IV.** (0-3-2) Cr. 3 each. Yr.
Prerequisite: 303.
Leadership; military law; military teaching methods; psychological warfare; construction; utilities, and job management; river crossing operations; engineer support for the air force and field army.

Courses in Field Artillery Unit

221, 222, 223. **Military Science II.** (0-1-2) Cr. 1 each. Yr.
Prerequisite: 113 or services in the armed forces or three years service in a federally recognized Junior ROTC.
Leadership; organization; materiel service of the piece; instruments; communication; motors and transportation.

321, 322, 323. **Military Science III.** (0-3-2) Cr. 3 each. Yr.
Prerequisite: 223, or extended military services in the armed forces.
Leadership; communication; duties of battery executive; tactics; individual weapons and preliminary marksmanship; gunnery; supply and evacuation.

421, 422, 423. **Military Science IV.** (0-3-2) Cr. 3 each. Yr.
Prerequisite: 323.
Gunnery; surveying; fire direction center; advanced artillery tactics; command and staff; combat intelligence; the military team; new developments. Leadership; psychological warfare; teaching methods; administration; military law.

Courses in Signal Corps Unit

231, 232, 233. **Military Science II.** (0-1-2) Cr. 1 each. Yr.
Prerequisite: 113, or service in the armed forces, or three years service in a federally recognized Junior ROTC and classification in engineering or science.
Evolution of communication; duties of communication personnel and practical exercises in installation and operation of communication means; organization for national defense; missions; functions; and capabilities of the signal corps, infantry, armored and airborne divisions; signal companies and communication component.

331, 332, 333. **Military Science III.** (0-3-2) Cr. 3 each. Yr.
Prerequisite: 233, or extended service in the armed forces.
Communications security; signal orders; capabilities and limitations of field radio communications; wire communication; applied signal communication; communication center procedure; signal supply and repair; career guidance for signal corps officers.

431, 432, 433. **Military Science IV.** (0-3-2) Cr. 3 each. Yr.
Prerequisite: 333.
Functions, capabilities and practical application of various types of wire and radio communications materiel normally employed by the infantry division; higher echelon signal communication and equipment; post signal operations; photography; command and staff; combat intelligence; career guidance for signal corps officers.

Courses in Veterinary Unit

151, 152, 153. **Military Science I.** (0-1-0) Cr. 1 each. Yr.
Military fundamentals, organization of the Army, Air Force and Medical departments; military law; administration; map reading and veterinary units.

251, 252, 253. **Military Science II.** (0-1-0) Cr. 1 each. Yr.
Duties of Veterinary officers; organization and employment of veterinary service in zone of interior and theater of operations; Medical department supply; animal management; military public health.

351, 352, 353. **Military Science III.** (0-1-0) Cr. 1 each. Yr.
Subsistence procurement; veterinary food inspection service; personnel management; physical examination of animals; movement of animals by rail, water and air.

451, 452, 453. **Military Science IV.** (0-1-0) Cr. 1 each. Yr.
Veterinary preventative medicine; veterinary aspects of atomic and chemical warfare; food products inspection. Organized Reserve Corps and mobilization.

COURSES IN NAVAL SCIENCE

Professor of Naval Science, Captain Eugene Trafethen Seaward, USN, B.S.

Associate Professors: CDR J. C. G. Wilson, USN, B.S.; CDR Earl Arthur Leuhman, USN, B.S.; LCDR Gerald Francis Carney, USN; LCDR John Warren Sedwick, USN, B.S.; LCDR Harlan Lon Cheney, USN, B.A.; Maj. Thomas Nicholls Greene, USMC, B.A.

Instructors: Walker, QMC, USN; Flota, GMC, USN; Cummings, FCC, USN, Crumb, M/Sgt. USMC; Gagner, ET1, USN

The first Naval Reserve Officers Training Corps units were established in 1926 There are now 52 units in various colleges and universities throughout the United States. Iowa State College is the only college in the state of Iowa which has an NROTC unit.

The function of the Naval Reserve Officers Training Corps is to provide, by a permanent system of training and instruction in essential naval subjects at civil educational institutions, a source from which qualified officers may be available for the Navy and the Marine Corps, and the Naval Reserve and the Marine Corps Reserve.

There are two types of NROTC enrollees, the *Regular* and the *Contract*. The programs are similar in that all students pursue studies of their choice leading to a baccalaureate degree and in addition take one naval science course each quarter.

In addition to completing the prescribed naval science course each midshipman enrolled in the NROTC must fulfill the following additional course requirements:

a. By the end of the sophomore year, every regular NROTC student must have satisfactorily completed one year of college physics.

b. By the end of the sophomore year, every student must have completed satisfactorily mathematics courses through trigonometry. Credit will be given for mathematics taken in secondary school.

c. Every student must achieve proficiency in written and oral expression in accordance with the standards prescribed by the College.

It is desirable that every student complete the following:

a. A sequence in mathematics, extending through calculus, and including spherical trigonometry.

b. A second year of physical science, such as advanced electricity and elementary electronics, for other than engineering students.

c. A one year sequence in personnel management and administration.

d. A one year course in world politics and international organization.

e. Two years of foreign language, or demonstrate by examination that he possesses a good reading knowledge and can make an acceptable written translation of one of the languages.

f. A course in public speaking.

NROTC students are not required to major in Naval Science. They may select any curriculum or major in the College with the exception of Veterinary Medicine Students may not be enrolled in courses preparatory to the study of dentistry, medicine, theology, or pharmacy. Recommended fields of study are Engineering, Mathematics, Physical or Social Sciences, and Industrial Economics.

The regular student is provided the following by the government: uniforms, textbooks, college tuition and fees, and $600 a year in pay. The academic work of the school year is supplemented by two summer cruises and one summer of aviation-amphibious training. Upon receipt of his bachelor's degree, the student is commissioned in the Navy or in the Marine Corps. He is then required to serve on active duty for three years, at the end of which time he may choose the service for a career or go to inactive duty in the Reserve.

The contract student takes only one summer cruise of three to eight weeks' duration. He receives uniforms and is paid, during his junior and senior years, about $27 a month. He must agree to accept a commission in the Naval or Marine Corps Reserve if offered, and to serve on active duty after graduation for a period of two years if called. After being commissioned he may apply for active duty.

The general objectives of the program are:

1. To provide the student with a well-rounded course in basic subjects, which, in conjunction with a baccalaureate degree, will qualify him for a commission in the United States Naval Service.
2. To develop a knowledge of, and an interest in, naval customs and traditions.
3. To develop a capacity for leadership.

Opportunities for Undergraduate Study

Required and supporting courses for the major in Naval Science in the curriculum in Science: Completion of Naval Science 311, 312, 313, 311M, 312M, 313M, and choice of 411, 412, 413 or 411M, 412M, 413M, with minors in mathematics and choice of physics, electrical engineering, mechanical engineering or general engineering. The following courses should be included in group requirements or electives: Physics 211, 212, 213 or 221, 222, 223, and 445, 446 (unless Electrical Engineering is minor); Zoology 104, 105 and 203; Economics 261, 262; Psychology 204 and 464; History 331, 332, 333; General Engineering 351, 354, 425; Electrical Engineering 338, 339, 340.

Description of Courses

Courses Primarily for Undergraduate Students

111, 112, 113. **Naval History and Orientation.** (0-3-2) Cr. 3 each. Yr
111. Naval Customs and organization; naval history from early Mediterranean and Roman period through World War I.
112 Naval history from World War I through World War II; regulations, discipline, and ships' characteristics.
113. Functions and employment of naval components; seamanship, tactics, nautical rules.

211, 212, 213. **Naval Weapons.** (0-3-2) Cr. 3 each. Yr.
211. Capabilities and limitations of all types of modern naval weapons; explosives.
212. Fire control. Basic principles of the employment and control of naval surface and anti-aircraft weapons.
213. Fundamentals of operation and employment of radar and sonar; nuclear explosives and guided missiles.

311, 312, 313. **Navigation.** (0-3-2) Cr. 3 each. Yr.
311. Navigation instruments and equipment, piloting, elements of navigation, relative movement, radar, loran.
312. Nautical rules of the road, basic aerology, celestial navigation, and nautical astronomy.
313. Celestial navigation, and navigator's days work

311M. **History of the Art of War.** (0-3-2) Cr. 3. F.
The art of war as developed through the ages. Marine Corps students will begin their specialty fall quarter of their third year.

312M. **Modern War and United States Military History Through the War with Mexico.** (0-3-2) Cr. 3. W
Modern military organization, strategy and tactics of World War II; origin and development of United States armed services.

818M. **United States Military History and Policy, 1860-1950.** (0 3-2) Cr. 3. S.
Analysis of selected battles; development of weapons, tactics and United States military policy.

411. **Naval Machinery.** (0-3-2) Cr. 3. F.
Theory and construction of typical modern naval engineering installations, properties of steam.

412. **Diesel Engines and Ship Stability.** (0 3-2) Cr 3 W.
Theory, construction, and operation of the diesel engine, principles of ship stability and buoyancy, damage control.

413. **Naval Justice and Leadership.** (0-3-2) Cr. 3. S.
Administration psychology and technique of leadership, duties and responsibilities of officers.

411E. **Naval Application of Thermodynamics and Power Generation.** (0-1-1) Cr. 1. F
For students with credit or classification in M.E. 344 or equivalent.

411M. **Amphibious Warfare.** (0 3-2) Cr. 3. F.
Basic principles and organization for amphibious war.

412M. **Amphibious Warfare.** (0-3 2) Cr. 3. W
Advanced principles and organization for amphibious war; analysis of selected amphibious operations.

418M. **Leadership and the Uniform Code of Military Justice.** (0-3-2) Cr. 3. S
Uniform code of military justice; administration psychology and technique; duties and responsibilities of officers (Marine viewpoint)

COURSES IN AIR SCIENCE AND TACTICS

Professor of Air Science and Tactics: Col. Alexander G. Evanoff, B.S.
Professor of Air Science and Tactics: Lt. Col. Henry H. Schwane, B.S.

Associate Professors: Maj. Horace Roger Gonzalez, B.A.; Major James Emmett Jordan, Jr., B.S.

Assistant Professors: Maj. William Filson Boore, M.S.; Maj. Richard O. Fischer, B.S.; Maj. Robert C. Hall, B.S.; Maj. Alpheus Miles Jennings, M.S.; Maj. Harland S. Laycock, B.S.; Maj. Eugene Elliot Stish, M.A.; Capt. Dean Glazier Hall, B.S.; Capt. Reuben A. Yellen, B.S.

Instructors: M/Sgt. Auchard, M/Sgt. Kovach, M/Sgt. Muehlbach, M/Sgt. Sanders, M/Sgt. Straka, T/Sgt. Carothers, T/Sgt. Paluska, T/Sgt. Sutton, S/Sgt. Palmer, S/Sgt. Stickel

The Air Force Reserve Officers Training Corps was first established at Iowa State College in 1946 as a part of the department of Military Science and Tactics. Specialized training in air force subjects was carried out only in the two years of the advanced course. In keeping with the intent of unification as established in the National Military Establishment the Air Force Reserve Officers Training Corps was placed on an equal level to that of the army and navy in 1949. The courses of instruction were changed to offer three years of training in specialized work, each leading to a commission in the Air Force Reserve.

The first year basic course provides training in military subjects common to army and air force and is carried out on a joint instruction basis between the two services. In the second year basic and the two years of advanced work the student receives training in the duties of a junior air force officer with emphasis on technical training in the field of air communications or non-technical training in air force administration. The prerequisite basic course is waived for veterans who have had extended military service.

Description of Courses

Courses Primarily for Undergraduate Students

141, 142, 143. **Air Science I.** (0-1-2) Cr. 1 each. Yr.
Leadership, drill and exercise of command; military organization; military policy of the United States; evolution of warfare; maps and aerial photographs; military psychology; first aid and hygiene; geographical foundation of nation power; military problems; military mobilization and demobilization.

241, 242, 243. **Air Science II.** (0-1-2) Cr. 1 each. Yr.
Prerequisite: 143, or service in the armed forces or three years' service in a federally recognized Junior ROTC.
Leadership, drill and exercise of command; aerodynamics and aircraft propulsion; navigation; meteorology; applied air power.

341, 342, 343. **Air Science III. Administration.** (0 3-2) Cr. 3 each. Yr.
Prerequisite: 243, or extended service in the armed forces.
Leadership, drill and exercise of command; logistics; air operations; air force administration.

344, 345, 346. **Air Science III. Communications.** (0-3-2) Cr. 3 each. Yr.
Prerequisite: 243, or extended service in the armed forces.
Leadership, drill and exercise of command; logistics; air operations; air force communications.

347, 348, 349. **Air Science III. Armament.** (0-3-2) Cr. 2 each.
Prerequisite: 243, or one year's service in the armed forces; major in engineering or scientific field.
Air operations; elementary air force supply procedures; military publications; specialized training in armament.

351, 352, 353. **Air Science III. Flight Operations.** (0-3 2) Cr. 2 each.
Prerequisite: 243, or one year's service in the armed forces.
Air operations; leadership, drill and exercise of command: elementary air force supply procedures; military publications; specialized training in flight operations.

441, 442, 443. **Air Science IV. Administration.** (0-3-2) Cr. 3 each. Yr.
Prerequisite: 343.
Leadership, drill and exercise of command; military administration; Inspector General; military teaching methods; military law and boards; air force management; career development; air force administration.

444, 445, 446. **Air Science IV. Communications.** (0 3-2) Cr. 3 each. Yr.
Prerequisite: 346.
Leadership, drill and exercise of command; military teaching methods; Inspector General; military law and boards; air force management; career development; air force communications.

447, 448, 449. **Air Science IV. Armament.** (0 3-2) Cr. 2 each.
Prerequisite: 349.
Leadership, drill and exercise of command; air force inspection systems; military teaching methods; military law and boards; military management; career development; specialized training in armament.

451, 452, 453. **Air Science IV. Flight Operations.** (0-3 2) Cr. 2 each.
Prerequisite: 353.
Leadership, drill and exercise of command; air force inspection systems; military teaching methods; military law and boards; military management; career development; specialized training in flight operations. Graduates of this course will be required to continue their training, as an officer, at an air force flying training school.

Mining Engineering

For description of courses, see Department of Chemical and Mining Engineering, courses in Mining Engineering, page 126

Modern Languages

ALFRED PAUL KEHLENBECK, Ph.D., Head of Department

Professor: Louis DeVries, Ph.D.

Assistant Professors: Erwin Clarence Bleckley, M.A.; John Codman Fiske, A.M.; Frederick Schwartz, Ph.D.

Instructors: Murphy, Ottis, Zimmerman

Opportunities for Undergraduate Study

The instruction offered in the Department of Modern Languages is designed to give the student the basic fundamentals in French, German, Russian or Spanish and to introduce the student to the culture of the people whose language is chosen.

Elementary and intermediate courses in the languages mentioned above are offered in the 200 and 300 series (for Russian, the 400 series). It is possible to obtain three year's work in German or Spanish. The student in Science will find it best to satisfy his language requirements by taking all of his work in one language. Senior college students, however, find it more advantageous to take a year each of French and German in the 400 series if the head of the major department so advises. One section of German, 441, 442, 443, is designed especially for students in Chemical Technology. The 411, 412, 413, French, and 441, 442, 443, German, are recommended for graduate students who need preparation for the foreign literature of their fields.

Students majoring in other departments, who are preparing to teach in the public school system may find a minor in Modern Languages useful.

Description of Courses

Courses Primarily for Undergraduate Students

201, 202, 203. **Elementary French.** (0-3-0) Cr. 3 each Yr
Minimum essentials of construction and vocabulary with a semi oral approach

231, 232, 233. **Elementary German.** (0 3 0) Cr. 3 each Yr
Minimum essentials of construction and vocabulary presented primarily for reading ability.

251, 252, 253. **Elementary Scandinavian.** (0 3 0) Cr. 3 each. Yr
Comparative structure and vocabulary for Danish, Norwegian and Swedish.

261, 262, 263. **Elementary Spanish.** (0-3 0) Cr. 3 each. Yr
Minimum essentials of construction and vocabulary with a semi-oral approach

301, 302, 303. **Intermediate French.** (0-3 0) Cr 3 each Yr
Prerequisite: 203.
Reading of modern French prose An opportunity for conversation if desired

331, 332, 333. **Scientific German.** (0 3 0) Cr. 3 each Yr
Prerequisite: 233.
Selected readings in biological, chemical, geological and physical subjects

341, 342, 343. **Modern German Prose.** (0 3 0). Cr 3 each Yr
Prerequisite: 233
Introduction to German civilization and modern literature

361, 362, 363. **Intermediate Spanish.** (0-3 0) Cr. 3 each Yr
Prerequisite: 263.
Reading of modern Spanish-American prose An opportunity for conversation if desired.

371, 372, 373. **Commercial Spanish I.** (0 3 0) Cr. 3 each Yr
Prerequisite: 363.
Reading of Spanish-American commercial literature Writing commercial reports Oral work

Courses for Advanced Undergraduate and Graduate Students

411, 412, 413. **Reading Knowledge of French.** (0 3 0) Cr 3 each or required. Yr
If taken by graduate students, required without credit

421, 422, 423. **Elementary and Reading Knowledge of Russian.** (0-3-0) Cr 3 each or required Yr
If taken by graduate students, required without credit.

431, 432, 433. **Intermediate Russian.** (0 3 0) Cr. 3 each Yr
Prerequisite: 423.
Reading of modern Russian prose

441, 442, 443. **Reading Knowledge of German.** (0 3 0) Cr 3 each or required Yr
If taken by graduate students required without credit

Music

ALVIN RANDALL EDGAR, M.A., D.Mu., Head of Department

Professor: Tolbert MacRae

Associate Professors: Ilza Louise Niemack; Ira Schroeder, B.Mu.

Assistant Professors: Max Vernon Exner, M.A.; John Eugene Hilligoss, Ph.D; Frank Arthur Piersol, M.A.

Instructors: Reeder, Snodgrass, Worden

Opportunities for Undergraduate Study

The aim of the Department of Music is to afford students who have an interest in music a means of developing their musical ability. An opportunity is offered to gain cultural advantage by active participation in the various ensemble organizations which are under the direction of the members of the music faculty.

The following musical organizations are maintained by the College: Iowa State Singers, Men's Glee Club, Women's Glee Club, Festival Chorus, Symphony Orchestra, and Concert Band. All of these societies give concerts during the year, and the Concert Band, Singers and Symphony Orchestra go on concert tours.

Description of Courses

Courses Primarily for Undergraduate Students

Iowa State College Festival Chorus. Yr.
Glee clubs; members of student body and faculty are eligible. Interpretation of choral work, secular and sacred.

111, 112, 113.† **Band.** (0 2-0) Cr. 1 each. Yr.
Open to all students who qualify. Concerts and annual tour in addition to playing for convocations and athletic events.

141, 142, 143 **Glee Clubs.** Cr. 1 each Yr.
Men's and women's glee clubs are open to all students by application to the director. Rehearsals twice weekly, plus Festival Chorus.

144.† **Music Appreciation.** (0 2-0) Cr. 1. F.W.S
Designed to acquaint students with form and meaning of good music. Lectures demonstrated by musical selections.

151, 152, 153.† **Orchestra.** (0 2-0) Cr. 1 each. Yr.
Open to all students who qualify. Concerts presented each quarter; annual tour Winter Quarter

161, 162, 163.† **Iowa State Singers.** (0 2 0) Cr. 1 each. Yr.
Open to all students

311, 312, 313.† **Private Music Lessons.** (0-1 0) Cr. 1 each Yr.
Private instruction in any branch of music, including harmony See page 81 for fee.
A. Voice.
B. Piano.
C. Organ.
D. String Instruments.
E. Band Instruments.
F. Harmony.

361.† **Conducting.** (0-2 0) Cr. 1. W.
Prerequisite: Permission of department head
Preparation for conducting band, orchestra, or choral club Major emphasis on technique of conducting. Demonstration and laboratory.

Naval Science

For description of courses, see Department of Military Science, page 278

†A total of not more than 8 credits in music will be allowed toward graduation

Physical Education for Men

LOUIS EDMOND MENZE, B.S., Head of Department

Associate Professors: Ray O. Donels, M.A.; Hugo Medford Otopalik, A.B.; Harry J. Schmidt, M.A.; Emmett Richard Stuber, B.S.; Clayton Sutherland, B.A.; Beryl S. Taylor, M.S.; LeRoy Clinton Timm, M.A.

Assistant Professors: Burl V. Berry, M.S.; Herbert Preston Cormack, M.A.; Russell Edward Dickinson, M.A.; Robert W. Lamson, B.S.; Jack Miller McGuire, B.S.; Wiley Burton Moore, A.B.

Opportunities for Undergraduate Study

For undergraduate curriculum in Science, major in Physical Education, leading to the degree of Bachelor Science, see page 145.

The curriculum in Science, with major in Physical Education, prepares the student to teach a science or physical education, to coach athletics or to direct recreational programs for schools, camps, industries or communities.[1] Majors in physical education for men usually choose minors from the fields of general science, agriculture, industrial education, mathematics, and social sciences as teaching areas, or from technical journalism and radio. Each student's program is designed to fit his particular needs and interests. Specific inquiries should be directed to the head of the department.

The work of the department includes required courses for freshmen and sophomores, elective courses for upperclassmen, and competitive programs in intramural and intercollegiate athletics. In the first year the required program introduces the student to eighteen recreational sports. In the second year the student has opportunity for further instruction in sports in which he is most interested.

Through the intramural program every man is given an opportunity to participate in competitive sports. The intramural program includes football, touch football, softball, basketball, volleyball, wrestling, tennis, indoor and outdoor track, handball, horseshoe pitching, baseball, golf, archery, fencing, hockey, table tennis, and swimming. The facilities of the department include an eighteen hole golf course, tennis courts, an ice skating area, playfields, gymnasium and swimming pool.

Intercollegiate athletics are under the direction of the Athletic Council. The Iowa State College is a member of the Missouri Valley Intercollegiate Athletic Association and is subject to the rules of this conference. The College is also a member of the National Collegiate Athletic Association and is committed to tolerate only clean and wholesome sport and to promote good sportsmanship among contestants and spectators. The College is represented by intercollegiate teams in football, cross country, basketball, wrestling, swimming, indoor and outdoor track, baseball, tennis, and golf.

Description of Courses

Courses Primarily for Undergraduate Students

101, 102, 103. Physical Education. (0-0-2) Required each Yr.

101C, 102C, 103C. Individual Physical Education. (0-0-2) Required each. Yr.
On recommendation of hygiene department in substitution for 101, 102, 103.

201, 202, 203. Physical Education. (0 0 2) Required each. Yr.

[1]See page 321 for the Iowa requirements for teacher certification.

201C, 202C, 203C. **Individual Physical Education.** (0-0-2) Required each. Yr.
On recommendation of hygiene department in substitution for 201, 202, 203.

212. **Gymnastics.** (0-1-4) Cr. 3. S.
Techniques and theory of gymnastic activities, including tumbling and apparatus.

213. **Introduction to Physical Education.** (0-3-0) Cr. 3. F.
An introductory course designed to develop leadership techniques, measure aptitudes, and orient each student in the general areas of physical education.

214. **Football Techniques.** (0-1-4) Cr. 3. F.S
Introduction and practice in fundamental skills of football.

215. **Basketball Techniques.** (0-1-4) Cr. 3. W.
Instruction and practice in fundamental skills of basketball.

216. **Track and Field Techniques.** (0-1-4) Cr. 3. F.S.
Instruction and practice in fundamental skills of track and field events.

217. **Baseball Techniques.** (0-1-4) Cr. 3. S.
Instruction and practice in fundamental skills of baseball.

218. **Advanced Swimming Techniques.** (0-1-4) Cr. 3. F.S.
Prerequisite: Ability to pass First Grade swimmer's test.
Instruction and practice in all swimming skills, life saving, and methods of teaching such skills.

219. **Physical Education Activities.** (0 1-4) Cr. 3. W.
Prerequisite: 101 or equivalent.
Instruction and practice of a series of seasonal physical education and recreational activities including wrestling, boxing, volleyball, bowling, tumbling and winter sports.

220. **Physical Education Activities.** (0 1-4) Cr. 3. S.
Prerequisite: 102 or equivalent.
Instruction and practice of a series of seasonal activities including handball, rhythms, golf, tennis, badminton and archery.

301. **Football Officiating.** (0-1-2) Cr. 2. F.
Rules and practice.

302. **Basketball Officiating.** (0-1-2) Cr. 2 W.
Rules and practice.

303. **Baseball Officiating.** (0-1-2) Cr. 2. S.
Rules and practice.

309. **Athletic Training.** (0-3-0) Cr. 3. F.S.
Prerequisite: 201, 202, 203.
Principles governing conditioning for various sports; diet, sleep, bathing, massage; overtraining; prevention and care of injuries.

314, 315, 316, 317. **Coaching of Athletic Sports.** (3-0-0) Cr. 3 each.
314. S.; 315. W.; 316. W.; 317. S.
Prerequisite: 201, 202, 203, 214 for 314, 215 for 315, 216 for 316, 217 for 317.
History, rules, theory, coaching methods. (314) Football. (315) Basketball. (316) Track. (317) Baseball.

318. **History of Physical Education.** (0-3-0) Cr. 3. F.
Prerequisite: Classification as a junior in the curriculum in Science (major in Physical Education).
Evolution of modern physical education, its many activities, its place in the educational pattern of each period.

319. **Organization and Administration of Intramural Athletics.** (0-3-0) Cr. 3. W.
Conduct and direction with special emphasis on place at the secondary level.

411, 412, 413. **Supervised Teaching in Physical Education.** (0-0-3 or 6) Cr. 1 or 2.Yr.
Practice with school and college groups.

490. **Special Problems.** Cr. 2 to 5. F.W.S.
Open to seniors majoring in physical education for men.
Conferences and preparation of report on individual problems.

491. **Principles of Physical Education.** (0-3-0) Cr. 3. F.
Prerequisite: V.Ed. 304.
Interpretation of objectives of physical education and health education. Analysis of activities in terms of developmental objectives.

492. **Methods of Teaching Physical Education.** (0-3-0) Cr. 3. W.
Prerequisite: Psych. 334.
Application of general educational methods to physical education. Special methods of teaching activities not covered in 314, 315, 316, 317.

493. **Organization and Administration.** (0-3-0) Cr. 3. S.
Prerequisite: 201, 202, 203.
Organization and administration of physical education and athletics. Program for required and elective courses, intramural and interschool athletics.

494. **Community and Industrial Recreation.** (0-3-0) Cr. 3. F.
Prerequisite: 10 credits toward Physical Education major.
Conduct and direction of recreational programs.

Physical Education for Women

GERMAINE GLADYS GUIOT, Ed.D., Head of Department

Associate Professor. Barbara Ellen Forker, M.S.

Assistant Professors: Madge H. Bowers, B.S.; Betty L. Toman, B.S.

Instructors: Carswell, Taylor, Watts

Opportunities for Undergraduate Study

The Iowa State College with its physical education building for women affords unusual opportunity for the development of recreational activities through this department. Besides the indoor facilities found in the new plant, such as gymnasia with dressing rooms and showers, dance studio, individual activity room, swimming pool, and indoor golf and archery ranges, extensive out-of-door facilities are provided. A sodded seventeen acre women's playfield is adjacent to the women's gymnasium. Tennis, archery, field hockey, speedball, softball and golf are among activities this new addition affords. Eight hard surfaced tennis courts are available.

Freshman and sophomore students are required to enroll in physical education for six quarters.

One purpose of the physical education program is to instruct students in leisure-time activities, thus preparing them to adjust to future social and community living. The department offers various activities in team games, individual sports and rhythmic activities. For the first three quarters, the student must select one activity from each of these fields. The remaining three quarters of work may be selected without restriction.

Another purpose of the department is to adapt the activities to each student's needs. A medical examination, given by the medical staff of the Student Health Service, is required upon entrance to the College. If special posture education or a restricted activity program is found necessary for a student, the department provides work in an individual activity class which is adapted to individual needs and capacities.

A teaching minor in physical education may be completed by taking courses 326, 330, 336 and 338. These, with 3 units of physiology or 3 units of P.E. 324, meet the state requirements.

Description of Courses

Courses Primarily for Undergraduate Students

121, 122, 123, 221, 222, 223. Physical Education. (0 0 3) Cr. 1 each. Yr.
Activities in the following fields:
Rhythmic Activities: Modern Dance, Intermediate Modern Dance, Advanced Modern Dance, Tap, Advanced Tap, Folk Dancing, American Country Dances.
Individual Sports: Badminton, Tennis, Intermediate Tennis, Archery, Advanced Archery, Bowling, Golf, Intermediate Golf, Advanced Golf, Skating, Swimming, Intermediate Swimming, Advanced Swimming, Life Saving.
Team Games: Volleyball, Basketball, Advanced Basketball, Hockey, Baseball, Speedball.
Each student must select one quarter's work from each of the above fields. The remaining three quarters of required work may be chosen without restriction.

***324. Physical Education.** (0-0 3) Cr. 1
324A. (0-0-3) Cr. 1. F.W.S.
324G. (0-0-3) Cr. 0 For graduate students only F.W.S.
Any activity not already used toward credit. Theoretical study of activity selected

*All students classified in 324, 326, 330, 336 and 338 are required to have had 2 years of physical education.

*326. **Recreational Leadership.** (0-2-3) Cr. 3. S.
Prerequisite: Two years required Phys.Ed.
Theory of play, organization and administration of play centers. Recreational programs studied and planned with leadership experience.

*330. **Principles of Physical Education.** (1-2-0) Cr. 3. F.
Survey of philosophies and principles of modern physical education with emphasis on health and recreation program.

*336. **Technics of Individual Sports for High School Girls.** (1-0-6) Cr. 3. S.
Prerequisite: 330.
Theory of practice of skills involved. Analysis of rules and strategy.

*338. **Technics of Team Games for High School Girls.** (1-0-6) Cr. 3. W
Prerequisite: 330.
Theory and practices of skills involved. Analysis of rules and strategy.

Courses for Advanced Undergraduate and Graduate Students

590H. **Special Topics.** Cr. 1 to 5. Miss Guiot
For description, see General Vocational Education, page 323

Physics

GERALD WILLIS FOX, Ph.D., Head of Department

Professors: J. Franklin Carlson, Ph.D.; Percy Hamilton Carr, Ph.D.; Lester Thomas Earls, Ph.D.; Don Kirkham, Ph.D.; Julian Knause Knipp, Ph.D.; L. Jackson Laslett, Ph.D.; Dean W. Stebbins, Ph.D.

Associate Professors: Gordon C. Danielson, Ph.D.; Earling N. Jensen, Ph.D.; Joseph Michels Keller, Ph.D.; William Kunerth, Ph.D.; Sam Legvold, Ph.D.; Louis Erwin Pinney, Ph.D.; Herbert John Plagge, M.A.; R. L. Sinsheimer, Ph.D.; Harold Stiles, Ph.D.; D. J. Zaffarano, Ph.D.

Assistant Professors: Lee Wright Butler, A.B.; Donald E. Hudson, Ph.D.; Arno Richard Kassander, Jr., M.S.; James E. McDonald, M.S.; Glenn H. Miller, Ph.D.; Lawrence Herrick Willson, B.S.

Instructors: Altshuler, Heller, Kerner, Stewart

Opportunities for Undergraduate Study

For undergraduate curriculum in science, major in physics, leading to the degree of Bachelor of Science, see page 145

The curriculum in science with a major in physics is quite flexible. It is designed to prepare a student for work in a research or engineering laboratory or for technical work associated with the testing of manufactured products. It also affords an excellent training for graduate work in physics leading to advanced degrees. By taking the required courses in education, students majoring in physics are well prepared for teaching at the secondary school level.

Undergraduate majors in this department normally include the following basic courses in their programs: 211, 212, 213 or 221, 222, 223; 311; 421, 422, 423; 454, 455; 494, 495; 425. As supporting work, undergraduate majors find the following courses desirable: Math. 101, 102, 103; 211, 212, 213; 314, 315; 451, 452, 453; Chem. 101, 102, 103. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counsellors who wish to estimate the amount of basic, non-specialized study which may be needed.

*All students classified in 324, 326, 330, 336 and 338 are required to have had 2 years of physical education.

Basic research in modern biology requires, in addition to a knowledge of biology, a broad understanding of the fundamentals of physics and chemistry and an adequate preparation in mathematics. A special program in biophysics has been designed to enable students interested in this important field to study these diverse disciplines in a coherent, balanced program Only well-qualified students will be accepted.

Opportunities for Graduate Study

The department offers work leading to the degrees of Master of Science and Doctor of Philosophy in physics, and minor work to students taking major work in other departments. Facilities of the department and of the Institute for Atomic Research, with which it is closely associated, permit theoretical and experimental investigations in many specialized fields, including solid state physics, nuclear physics and biophysics.

Students with bachelor's degrees will ordinarily qualify for graduate work provided their training has included sufficient emphasis on physics, mathematics, and chemistry.

Students who expect to become candidates for higher degrees in physics may find it necessary to acquire additional training at the intermediate level before undertaking more advanced work.

Ordinarily, students majoring in physics will minor in mathematics, chemistry, biology, or some field of engineering or agriculture, although other fields are also possible.

Open to graduate students for minor only: 311, 316, 324, 325, 334, 404, 421, 422, 423, 424, 425, 435, 436, 445, 446, 450, 454, 455, 474, 490, 494, 495, 496.

Description of Courses

Courses Primarily for Undergraduate Students

106. **Physics for Home Economics Students.** (2-2 3) Cr. 4 F.W.S
Elementary mechanics, heat, electricity and light applied to the home.

204. **Physics for Agricultural Students.** (1 2-0) Cr. 3. F.W.S.
Prerequisite: Math. 102, 205, or 241.
Various kinds of energy involved in plant and animal production and some newer methods of energy control.

211, 212, 213. **General Physics.** (1-2-2) Cr. 4 each. Yr.
Prerequisite: Math. 102 or 112. For science students.
Mechanics, heat, sound, light, electricity, magnetism, some topics from modern physics

221, 222, 223. **General Physics.** (4 0 3) Cr. 5 each. Yr
Prerequisite: Math. 211
For engineering students and students expecting to major in physics. (221) Mechanics (222) Heat, light, modern physics. (223) Sound, magnetism, electricity.

305. **Descriptive Meteorology.** (3-0-0) Cr. 3. F.
Significant weather processes. Composition and structure of the atmosphere, condensation and precipitation, wind-pressure relations, air masses and fronts, cyclones and anticyclones.

306. **General Climatology.** (3-0 0) Cr. 3. W.
Physical and regional climatology. Factors controlling temperature and precipitation, distribution, storms as climatic factors. Koeppen system of climatic classification, regional climatology of the world.

309. **Introduction to Exploration Geophysics.** (Geol. 309) (3-0-0) Cr. 3. S.
Prerequisite: Geol 202, credit or classification in 213 or 223, or permission of instructor.
Application of physical tools to the location of petroleum or mineral deposits. Seismograph, gravimeter, magnetometer, and electrical and radioactivity measuring devices.

311. **Physical Measurements.** (0 0-6) Cr. 2 each time elected. F.W.S.
Prerequisite: 213 or 223, Math. 213.
Experiments in electricity, optics, heat and other fields with emphasis on the effect of the instruments or the experimental method on the result.

316. **Photography.** (1-0-6) Cr. 3. F.S
Prerequisite: 218 or 228, or equivalent, and permission of instructor.
Methods and practices in photography; composition and lighting; corrective treatment of negatives; printing.

317. **Photography in Journalism.** (T.Jl. 317) (1-0-6) Cr. 3. S.
Prerequisite: 204, Chem. 103, or equivalents, and permission of instructor.
Methods and practices in photography; evaluation of photographs for journalistic use

324, 325. **Physical Meteorology.** (3-0-3) Cr. 4 each W.S.
Prerequisite: 305, credit or classification in 212 or 222 and Math. 212.
Atmospheric statics and thermodynamics, radiation processes, instruments, stability analysis, precipitation theories, icing of aircraft, theory of the visual range, atmospheric electricity.

334. **Dynamic Meteorology.** (3-0-0) Cr. 3. F.
Prerequisite: 325 and Math. 213.
Physical and mathematical theory of atmospheric motions. Coriolis acceleration, geostrophic and gradient wind relations, thermal and isallobaric wind, turbulence, circulation.

349. **General Astronomy.** (2-1-0) Cr. 3. S.
Prerequisite: 213 or 223.
Celestial coordinates, time, the moon, solar and lunar eclipses, the solar system, stars, star clusters, the galactic and extragalactic systems.

404. **Heat.** (3-0-0) Cr. 3. F.

Prerequisite: 213 or 223, Math. 213
Temperature, expansion, specific heat, convection, conduction, gas laws, kinetic theory, change of state, elementary thermodynamics, radiation, isothermal and adiabatic changes, measurement of high and low temperatures.

421, 422, 423. **Introduction to Modern Physics.** (3 0 0) Cr. 3 each. Yr.
Prerequisite: 213 or 223, Math. 213, Chem. 103.
Wave motion; kinetic theory of gases; specific heat and heat radiation, thermionics; photoelectric effect; special theory of relativity; X-rays, radioactivity and isotopes, nuclear physics, nuclear fission; cosmic rays.

424. **Geometrical Optics.** (2 0-0) Cr. 2. W.
Prerequisite: 213 or 223, Math. 213.
Optical constants of mirrors and lenses, image formation, aberrations, optical instruments, lens combinations.

425 **Physical Optics.** (4 0-0) Cr. 4. S.
Prerequisite: 213 or 223, Math. 213
Wave theory, absorption, dispersion, interference, diffraction, gratings, resolving power, polarization.

435, 436. **Nuclear Physics for Engineers.** (3-0 0) Cr. 3. F.W.
Prerequisite: 213 or 233, Math. 213.
Introductory nuclear physics, nuclear reactions, particle accelerators; nuclear fission, elementary diffusion theory, reactor design and control

445, 446. **Electronic Circuits and Instruments.** (E.E. 445, 446) See Electrical Engineering.

450. **Advanced Physics Laboratory.** (0 0 3 to 9) Cr. 1 to 3 each time elected. F.W.S.

Prerequisite: Permission of instructor.
This course is equivalent to undergraduate research. Registration will ordinarily be limited to one credit during the first quarter.

454, 455. **Analytical Mechanics.** (Math. 454, 455) See Mathematics.

474. **Electronics.** (E.E. 474) See Electrical Engineering

490. **Special Problems.** Cr. 1 to 6 each time elected F.W.S.
Prerequisite 311, 423, or equivalent

494, 495, 496 **Electricity and Magnetism.** (3-0-0) Cr. 3 each. F.W.S.
Prerequisite: 218 or 228, Math. 315.
Electrostatics, magnetostatics, steady currents, networks, chemical and thermal effects, electromagnetism, electric and magnetic instruments, induction, dielectrics, magnetic materials, electromagnetic waves.

Courses for Advanced Undergraduate and Graduate Students

506. **Vibrating Systems.** (3 0 0) Cr. 3. W.
Prerequisite: 213 or 223 Math. 314 Mr. Carlson
Mathematical treatment of a number of simple vibrating systems, such as the harmonic oscillator, flexible string, bars and membranes Introduction of methods and concepts used in advanced work in theoretical physics emphasized.

507. **Sound.** (3-0-0) Cr. 3. S.
Prerequisite: 506 or permission of instructor. Mr. Carlson
Propagation of sound waves in tubes and horns; radiation and scattering of sound; standing sound waves.

568. **Micrometeorology.** (3-0-0) Cr. 3. S.
Prerequisite: 325, 384. Mr. McDonald
Fundamental meteorological processes occurring in the layer of air near the ground: Heat exchange, radiative transfer, water vapor transfer. Influence of topography, vegetation cover and soil conditions on the microlayer.

514, 515, 516. **Analytical Emission Spectroscopy.** (Chem. 514, 515, 516) See Chemistry.

521. **General Laboratory in Experimental Physics.** (0 0 9) Cr 3 each time taken. F.W.S.
Prerequisite: Permission of instructor. Mr. Hudson
A series of experiments illustrating the techniques of measurement in current experimental physics, dealing with electrical circuits, electronic physics, sound, nuclear physics, heat, spectroscopy, geometrical and physical optics. Principal emphasis on treatment of both random and systematic errors and on methods of obtaining and interpreting data to obtain results of desired accuracy and reliability.

524. **Advanced Dynamic Meteorology.** (0-3-0) Cr. 3. W.
Prerequisite: 324, 334, Math. 314. Mr. McDonald
Theories of turbulence and turbulent transport. Role of momentum transport in control of surface winds. Heat transport and water vapor transport near the earth's surface. Applications of recent theoretical and experimental developments

525. **Photomicrography.** (0-0-6) Cr. 2. W.
Prerequisite: 316 and permission of instructor. Mr. Carr
The theory and practice of photomicrography in black and white and in color. Factors controlling contrast and resolution.

538. **Transients in Electronic Circuits.** (E.E. 538) See Electrical Engineering.

550. **Vector Analysis.** (Math. 550) See Mathematics.

551, 552, 553. **Introduction to Theoretical Physics.** (Math. 551, 552, 553) (3-0-0) Cr. 3 each. Yr.
Prerequisite: Math. 314. Mr. Legvold
(551) Differential equations, vector and tensor analysis with applications to elasticity (552) Kinematics and advanced dynamics using Newton's, Lagrange's, and Hamilton's equations of motion. (553) Hydrodynamics, electrostatics, magnetostatics, and Maxwell's field equations.

567, 568, 569. **Introduction to Biophysics.** (Bact. 567, 568, 569. Gen. 567, 568, 569.) (4-0-0) Cr 4 each. Yr.
Prerequisite: Fundamental training in biology, physics, calculus, organic and physical chemistry. Mr. Sinsheimer
Electronics and biology; nuclear physics and biology; spectroscopy and biology; methods for the study of macro-molecules; method of study of cellular structure.

577. **Soil Physics.** (Agron. 577) See Agronomy.

591, 592, 593. **Modern Physics.** (3-0-0) Cr. 3 each. Yr
Prerequisite: Math. 314, 20 credits in physics or permission of instructor Mr. Knipp
Restricted theory of relativity. Planck's theory of black body radiation. Elementary quantum theory of the atom, atomic structure and spectra, radioactivity, nuclear physics

Courses for Graduate Students

604, 605. **Empirical Spectroscopy.** (3 0-0) Cr. 3 each. Alt. W.S. Not offered 1953
Prerequisite: 424 425. Mr. Earls
Light sources; types and performance of spectrographic equipment for emission spectra, infrared through extreme ultraviolet. Atomic energy levels, using the vector model of the atom; fine structure, coupling types, Zeeman effect, hyperfine structure, perturbations, line breadths. Brief survey of molecular spectra in theory and experiment.

611, 612, 613. **Solid State Physics.** (3 0-0) Cr. 3 each. Yr.
Prerequisite: 553, 681 or permission of instructor. Mr. Danielson
Modern theory of metals, semiconductors and insulators using the free electron and band theory of solids, and including topics such as electronic specific heat, electrical and thermal conductivity, cohesion, diffusion in metals, order-disorder in alloys, rectification by semi-conductors, ferroelectricity, crystal counters, dislocations and plastic flow.

621, 622, 623. **Thermodynamics, Kinetic Theory and Statistical Mechanics.** (3-0-0) Cr. 3 each. Yr
Prerequisite: 404, Math. 514. Mr. Keller
(621) First and second laws of thermodynamics, thermodynamic potential functions, systems in various states of aggregation, gaseous reactions, dilute solutions and other applications. (622) Kinetic distribution laws, the H theorem, transport and fluctuation phenomena. (623) Statistical ensembles in classical mechanics and in quantum mechanics, statistical basis of thermodynamics, applications to specific problems.

624, 625. **Electron Theory.** (3 0 0) Cr. 3 each. W.S.
Prerequisite: 613, 623 or permission of instructor. Mr. Stebbins
Fundamental physical processes of electron emission (field, secondary, thermionic, photoelectric), contact potentials, electron optics, conduction through vacua and gases, photoconductivity, and photovoltaic effect.

626. **X-ray Crystal Structure.** (Chem. 626) See Chemistry.

634. **Advanced Optics.** (3-0-0) Cr. 3. F.
Prerequisite: 425. Mr. Earls
Plane and elliptically polarized light and interference; optical activity; wave surfaces in uniaxial and biaxial crystals, elements of electromagnetic wave theory; Lorentz dispersion theory; optical reflection and refraction in metals; fluorescence phenomena and other topics

640. **Special Topics.** F.W.S.
Prerequisite: Permission of instructor. Graduate staff

654, 655. **Dynamics.** (Math. 654, 655) See Mathematics.

660. **Advanced Biophysics.** (2-1-0) Cr. 3 each time elected. S.
Prerequisite: Permission of instructor. Mr. Sinsheimer
Biological effects of radiant energy, the application of stable and radioactive isotopes to biological problems, etc.

671, 672, 673. **Advanced Electricity and Magnetism.** (3-0-0) Cr. 3 each. Yr.
Prerequisite: 495, Math. 314, 514, and 550 or equivalent. Mr. Laslett
Electrostatics, magnetostatics, potential problems, steady electric currents, magnetic field of currents, electromagnetic field equations, electromagnetic induction, magnetic materials, alternating currents, radiation, and transmission of electromagnetic waves.

677. **Advanced Soil Physics.** (Agron. 677) See Agronomy

681, 682, 683. **Quantum Mechanics.** (Math. 681, 682, 683) (3-0-0) Cr. 3 each. Yr.
Prerequisite: 553 or permission of instructor. Mr. Carlson
Introduction to quantum mechanics. Solution of various physical problems by wave mechanical methods. Interaction of radiation with matter. Relativistic formulation of the theory.

690. **Research.** F.W.S.
Graduate Staff

Poultry Husbandry

ROBERT E. PHILLIPS, Ph.D., Head of Department

Professors. Leonard Z Eggleton, M.S.; Robert Penquite, Ph D

Associate Professors: Elton L. Johnson, Ph.D.; Arne W. Nordskog, Ph D , William Russell Whitefield, B.Sc.

Assistant Professors Owen Jay Cotterill, M.S ; Frank G Wollney, B S

Instructor: Ward

Opportunities for Undergraduate Study

For undergraduate curriculum in poultry husbandry leading to the degree of Bachelor of Science, see page 108.

The curriculum in poultry husbandry provides for a general education in agriculture with specialized training in subjects related to the production, processing, storage and distribution of poultry and egg products. Emphasis is also placed on providing the student with a general background in the sciences and humanities. The curriculum provides a liberal allowance of elective courses to be selected by the student in consultation with the departmental staff.

Students graduating in Poultry Husbandry find employment in many lines of work: commercial poultry farm managers and owners, specialized poultry breeding farm managers and owners, hatchery managers and owners, technologists in processing plants and poultry specialists for service work in agricultural journalism, government service, as well as in the feed and equipment industries.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in poultry nutrition, poultry breeding, avian physiology,

and poultry products technology; and minor work for students taking a major in other departments.

The completion of a suitable undergraduate curriculum including course work substantially equivalent to that given at this institution is required. This will include undergraduate courses which are prerequisite to the specialized field of work chosen for graduate study. A strong undergraduate background in science (biology, chemistry, and mathematics) is highly desirable for those who wish to pursue graduate study in these fields.

Open to graduate students for minor only: 319, 401, 490.

Description of Courses

Courses Primarily for Undergraduate Students

101 General Poultry Husbandry. (0 2-2) Cr. 3 F.W.S.
Principles and practices of poultry production Classification of breeds, culling, judging, housing and feeding. Introductory course for those who expect to specialize in poultry; arranged also for those who wish a single course in poultry husbandry.

102. Poultry Farm Management. (0 2 2) Cr 3 W.
Prerequisite: 101.
Development and organization of the commercial poultry farm enterprise. Feeding, housing and selection of laying stock (chickens and turkeys)

103. Advanced Poultry Farm Management. (0-2-2) Cr. 3 S
Prerequisite: 102
Principles and practices related to the incubation of eggs and the brooding, feeding and housing of young stock (chickens and turkeys)

301. Poultry Judging. (0 1 6) Cr. 3. F.
Prerequisite: 101.
History and development of breeds and varieties, production judging methods, standard judging methods, individual bird evaluation and flock appraisal. Trips to nearby produce plants.

302. Incubation and Hatchery Management. (0 2-2) Cr. 3. W.
Prerequisite 101, Zool 334
Problems in hatchery management including the incubation of eggs and the brooding of chicks in batteries Nearby hatcheries and poultry farms will be visited.

303. Poultry Show Organization and Administration. (0 1 4) Cr. 3 W.
Prerequisite: 101.
Organizing and managing poultry shows and exhibitions

319. Applied Animal Nutrition. (A H 319) See Animal Husbandry

320 Poultry Nutrition. (0 1 3) Cr 2 F
Prequisite 101 Chem 103 and 256, V Anat 217, A H 318
Practical aspects of poultry nutrition Feeding standards, formulation and mixing of rations; development and study of nutritional deficiencies

401. Marketing and Processing Poultry Products. (0 3 3) Cr. 4. F.
Prerequisite 101, Bact 304A, Chem 256 or 264, Ec 233.
Economic and technological problems of procurement, processing and market distribution of poultry and egg products including basic quality factors, quality maintenance, grading, storage, hedging, market news, market legislation and cooperative marketing Producer adjustments to changing market demands and technological improvements Trips to nearby processing plants

402. Poultry Breeding. (0 3 0) Cr. 3. S
Prerequisite: 101, Gen. 800.
Inheritance of egg production, egg size, hatchability, body size, viability and plumage color; methods of poultry breeding.

490. Special Problems. Cr. 1 to 3. Yr.
Open to senior college students showing satisfactory preparation for problem chosen and quality point average of 2 5 or above for two preceding quarters. Conferences and preparation of report on individual problems.

Courses for Advanced Undergraduate and Graduate Students

501, 502, 503 Poultry Seminar. (0 1 0) Cr. 1 each F.W.S.
Messrs. Johnson, Nordskog, Penquite, Phillips

504 Advanced Poultry Nutrition. (0 3 2) Cr 4 Alt. S. Offered 1953
Prerequisite 320, Vet Phys 364 Mr. Johnson
Nutritional requirements of poultry. Experimental rations and principles of nutritional research.

Courses for Graduate Students

601 **Advanced Poultry Breeding.** (0 3 0) Cr. 3. Alt W. Offered 1953
Prerequisite: 402. Mr. Nordskog
Survey of poultry genetics. Application of systems of breeding to poultry, including inbreeding, outbreeding, hybridization and methods of selection.

602. **Advanced Poultry Products Technology.** (0 2-0) Cr 2. Alt. S. Offered 1953
Prerequisite: 401, Chem. 474 Mr. Phillips
Research problems in poultry products; literature study; planning for and execution of research projects related to the processing, storage, distribution, and utilization of poultry and egg products.

603. **Seminar in Animal Nutrition.** (A H 603) See Animal Husbandry.

604. **Modern Views of Animal Nutrition.** (A H 604) See Animal Husbandry.

605. **Methods and Techniques in Animal Nutrition Experimentation.** (A.H.605) (2-0 3) Cr. 3. S.
Prerequisite: One course in statistics and permission of instructor. Messrs. Burroughs, Catron, Jacobson, Johnson
Methods and techniques in planning and conducting nutrition experiments with poultry, swine, cattle and sheep. Includes visits to experimental facilities

606A. **Institution Purchasing.** (A.H. 606A, I Mgt. 606A) (0 1-6) Cr. 3. S.
Prerequisite: A H 374, I Mgt 484 Messrs Kastelic, Kline, Phillips
Procurement and storage of poultry and egg products for institutions.

690. **Research.**
A. Poultry Breeding. Mr. Nordskog
B. Poultry Nutrition. Mr. Johnson
C. Avian Physiology. Mr. Phillips
D. Poultry Products Technology. Mr. Phillips

Psychology

WILLIAM ABBOTT OWENS, Ph.D., Head of Department

Professors: John Ellis Evans, Ph.D.; Martin Frederick Fritz, Ph.D.; *Richard Wellington Husband, Ph.D.; Alvhh R. Lauer, Ph D.; Thomas Franklin Vance, Ph.D.

Associate Professors: John A. Bath, Ph.D.; Glenn R. Hawks, Ph.D.

Assistant Professors: Don Claude Charles, Ph D.; Douglas S Ellis, Ph.D.; John Louis Holmes, M A.; Richard Burton McHugh, M.A.; Alice Lucille Palubinskas, M.A.

Instructors: Campbell, Colby, Collins

Opportunities for Undergraduate Study

For the undergraduate curriculum in science, major in industrial psychology, leading to the degree of Bachelor of Science, see page 145

The curriculum in science with a major in industrial or applied psychology is flexible and may be pursued, with variations, in preparation for such types of positions as the following: (1) test technician, (2) interviewer, (3) job or safety instructor, (4) employee counsellor, (5) student advisor, (6) psychological interne, (7) driver training instructor, (8) personnel technician, (9) *Junior Professional Assistant, and (10) *Junior Management Assistant. Students should realize, however, that to be employed as a professional psychologist it is practically essential to possess the M.S. or Ph.D. degree

The following courses are useful to persons preparing for industrial employment: 274, 335, 354, 464, 465, 474, 484 485, 565, 568.

The following courses are recommended for persons with interests in social science or education: 215, 274, 334, 414, 434, 448, 470, 474, 515, 516, 525, 534, 536, 538, 539, 542, 555.

*These are civil service appointments

Psych. 204 and 334, plus 414 or 433 or 434 will meet the psychology requirement for an Iowa Standard Secondary Teacher's Certificate See page 321

Undergraduate majors in this department usually have included the following basic courses in their programs: 204, 206 or 568, 304, 315 or 414, 334, 433, 434, 440 or 542, 464 and/or 465, 524. As supporting work, undergraduate majors have found the following courses desirable: Gen. 300; Math. 101, 112, 113 or Stat. 301, 302; Phys. 211, 212, 213 or Chem. 101, 102, 103; Soc. 234; Zool. 104, 105, 203. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counsellors who wish to estimate the number of basic non-specialized studies which may be needed.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in certain fields of applied psychology, and minor work to students taking major work in other departments.

Students desiring a graduate major in psychology must have graduated from a recognized technical or professional curriculum substantially equivalent to one of the undergraduate curricula of the Iowa State College. Prerequisite to admission is at least 15 quarter credits of basic psychology, which should normally include a laboratory course, a quantitative or methods course, and a course with developmental emphasis.

Open to graduate students for minor only: 414, 434, 440, 448, 474.

Description of Courses

Course for Noncollegiate Students

78. Automobile Driving Course. (0-0-2) Cr. 0. F.W.S.
For those learning to drive an automobile. (Fee $10)

Courses Primarily for Undergraduate Students

105. How to Study. (0-2-0) Cr. 1. Course six weeks in length and given twice each quarter. F.W.S.
Prerequisite: Consent of counselor or head of department.

106. Reading Improvement. Cr. 0 F.W.S

204. General Psychology. (0-3-0) Cr. 3. F.W.S.
Introduction to basic concepts of normal human behavior.

206 Laboratory in General Psychology. (1 0 2) Cr. 2. S.
Prerequisite: Credit or classification in 204 Not open to advanced undergraduates.
Introduction to laboratory procedures through experiments and demonstrations common to general psychology.

215 † Developmental Psychology. (0 5 0) Cr. 5. F W S
Principles of psychology relevant to the origin and development of an integrated personality; emphasis upon the periods of infancy and childhood.

274 Problems of Human Conservation. (0 3-0) Cr. 3. F
Survey of highway, industrial, farm and home safety. Principles of first aid; individual and group responsibility for accident prevention.

304. Advanced General Psychology. (0 3 0) Cr 3 S.
Prerequisite: 204.
Classic experiments and experimental concepts; methods and theories; physiological fundamentals.

315. Child Psychology. (0-3 0) Cr. 3. W.
Prerequisite: 204.
Methodology of child study; hereditary influences dynamics of intellectual, physical, emotional and social development; analysis of behavior problems.

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†This course combines 204 and 315 In figuring prerequisites for advanced courses it counts as 6 credits

320. **Special Problems.** (By Conf.) Cr. 1 or 2 each time elected. F.W.S.
Prerequisite: 5 credits in psychology (including elementary psychology), quality point average of 2.5 or above, permission of head of department.
Independent projects restricted to areas not covered by course offerings.

334. **Educational Psychology.** (0 3-0) Cr. 3. F.W.S.
Prerequisite: 204.
Nature of learning process; types of learning; efficient methods of learning.

335. **Psychology of Motivation.** (0 3-0) Cr. 3. S.
Prerequisite: 204.
Development and maintenance of interest, morale, and efficiency in industrial learning situations.

354. **General Applied Psychology.** (0-3-0) Cr. 3. W.
Prerequisite: 204.
Major problems and application of psychological principles in such fields as law, medicine, business and industry, selling and advertising, guidance and personnel.

414. **Psychology of the Adolescent.** (0-3-0) Cr. 3. F.S.
Prerequisite: 204, 334.
Characteristics and problems peculiar to the adolescent period of development and relatively independent of earlier stages of growth. Emphasis on the transition to adult attitudes and behavior as related to social, vocational and marital adjustment.

433. **Quantitative Concepts in Psychology.** (0-3-0) Cr. 3. W.
Prerequisite: 6 credits in psychology.
Illustration and interpretation of the most frequently employed statistical and psychometric techniques. Prepares students for intelligent reading of the psychological literature; not primarily computational.

434. **Tests and Educational Measurement.** (0-2 2) Cr. 3. F.W.
Prerequisite: 6 credits in psychology.
Administration and interpretation of the most commonly employed and most useful group, paper-and-pencil tests.

440. **Mental Hygiene.** (0-3-0) Cr. 3. F.
Prerequisite: 6 credits in psychology.
Concepts of normality and adjustment; implications of the abnormal for the normal; developmental application.

448 **Public Opinion and Attitude Analysis.** (0-3-0) Cr. 3. S.
Prerequisite: 3 credits in psychology and either 433 or 3 credits in statistics.
Determinants of opinion and attitude; formulation of questions and scales; psychometric methods; sampling; social implications and applications of polls and surveys.

464. **Industrial Psychology—Selection Techniques.** (0 3-0) Cr. 3. F.W.S.
Prerequisite: 204.
Organization and functions of an industrial relations department, job analysis and classification; employment techniques, with emphasis on testing.

465. **Industrial Psychology—Employee Efficiency.** (0 3-0) Cr. 3. F.S.
Prerequisite: 204, (464 recommended).
Producing and maintaining employee effectiveness on the job. Training, rating and promotion, safety, working conditions, efficient work, motivation and morale, labor relations.

470. **Practice of, and Supervised Teaching in, Driver Training Education.** (0-2-4) Cr. 3. W.
Prerequisite: 9 credits of psychology and a quality-point average of 2.2.
Teaching of driver education. Supervised experience behind the wheel and in charge of a learner's class.

474. **Psychology of Safety.** (0-3-0) Cr. 3. S.
Prerequisite: 204.
Psychological principles of industrial safety; techniques of accident prevention and human conservation.

484. **Psychology of Advertising.** (0-3-0) Cr. 3. F.W.S.
Prerequisite: 204.
Investigational approaches, analysis, and evaluation of all types of advertising materials with respect to the psychological principles involved.

485 **Psychology of Salesmanship.** (0-3-0) Cr. 3. F.
Prerequisite: 204.
Psychological principles underlying sound and successful salesmanship Persuading the customer, breaking down sales resistance, ethical considerations.

Courses for Advanced Undergraduate and Graduate Students

501. **Psychological Statistics.** (Stat. 501) See Statistics.

504 **Readings in Experimental Psychology.** (0 3 0) Cr. 3. W.
Prerequisite: 9 credits in psychology, including 304; 433 strongly recommended. Mr. Lauer
Analysis of experimental methods, findings and theories, with methodology stressed.

510 **History and Systems of Psychology.** (0-3-0) Cr. 3. F.
Prerequisite: 9 credits in psychology. Mr. Fritz
Philosophical, physical and clinical origins of psychology; points of view and interpretations of basic phenomena.

515. **Social Psychology.** (0-3-0) Cr. 3. W.
Prerequisite: 9 credits in psychology. Mrs. Palubinskas
Interaction of the individual with the group as affected by race, nationality, religion and other social phenomena.

516 **Advanced Child Psychology.** (0 3 0) Cr. 3. F.
Prerequisite: 315. Mr. Vance
Analysis and evaluation of methods and conclusions of current major researches in child psychology.

520. **Special Topics.** (0 1 to 3 0 to 3) Cr 1 to 4 each time elected. F.W.S.
Prerequisite: 9 credits in psychology and permission of instructor.
Messrs. Bath, Ellis, Evans, Fritz, Husband, Lauer, McHugh, Owens, Vance

A. Historical, Systematic, Theoretical.
B. Industrial and Safety.
C. Advertising and Sales.
D. Genetic and Geriatrics.
E. Experimental.
F. Educational and Learning.
G. Individual Differences and Psychometrics
H. Clinical and Abnormal.
I. Guidance, Personnel, Counseling.

524. **Individual Differences.** (0-3-0) Cr. 3. W.
Prerequisite: 6 credits in psychology and either 433 or 3 credits in statistics.
Mr. Owens
Evaluation of roles of sex, race, the family, environment and maturity in their contributions to individual differences; techniques analyzed. Trait differences compared and contrasted with individual differences

525. **Individual Testing.** (0-2-4) Cr. 3. W.
Prerequisite: 9 credits in psychology, including 434 and permission of instructor.
Mr. Evans
Basic assumptions of adult testing; practice in administration and interpretation of the most important individual intelligence and personality tests.

534. **Advanced Tests and Measurements.** (0 3-0) Cr. 3. S
Prerequisite: 433 and either 434 or 464. Mr. Owens
Test theory, development and evaluation; basic variables, qualifying concepts, current trends.

536. **Psychology of Vision and Efficient Seeing.** (0-3 0) Cr. 3. F.
Prerequisite: 9 credits in psychology and permission of instructor. Mr. Lauer
Theories and principles of vision and seeing; structures and experimental data; emphasis upon efficient use of the eyes in reading, observation and everyday affairs.

538. **Psychological Fundamentals of Guidance and Counseling.** (0-3-0) Cr. 3. F.
Prerequisite: 434. Messrs. Fritz, Holmes
Types and varieties of counseling problems, diagnostic tools and techniques, the case history, summary of information, the development of objectives, interviewing techniques and psychotherapy.

539 **Personal Counseling.** (0-3-0) Cr. 3. W.
Prerequisite: 538 and either 440 or 544. Messrs. Fritz, Holmes, Owens
The role of psychometric and projective techniques in the diagnosis of maladjustment; the place of the various counselor-centered and client-centered therapeutic methods.

542 **Psychology of Personality.** (0-3-0) Cr. 3. W.
Prerequisite: 9 credits in psychology, 434 recommended. Mr. Bath
Nature, development, structure, analysis and understanding of the normal adult personality.

544. **Abnormal Psychology.** (0-3-0) Cr. 3. S.
Prerequisite: 9 credits in psychology; 550 or V Anat 511 recommended. Mr. Evans
Abnormal mentality and mental disorders which affect individual adjustments; causation, diagnosis, prognosis, probable course and treatment of mental disease. Clinics in school for feeble-minded and hospital for insane.

550. **Physiological Psychology.** (0-3-0) Cr. 3. S.
Prerequisite: 9 credits in psychology, Zool. 203 Mr. Husband
Structure and function of nervous system of man as related to psychological activities.

555 **Psychology of Learning.** (0-3-0) Cr. 3. S.
Prerequisite: 9 credits in psychology; 334 recommended. Mr. Bath
Principles, types and bases of learning; theories and systematic implications.

565 **Experimental Industrial Psychology.** (0 3 0) Cr 3. W.
Prerequisite: 9 credits in psychology 433, 465 and 504 recommended. Mr. Ellis
Experimental bases of industrial psychology; methods, findings, and theories concerning problems of fatigue, efficiency, motivation, training.

568, 569. **Laboratory in Experimental Psychology.** (0 2 4) Cr. 3 each. F.W.
Prerequisite: 433 or equivalent.
Basic experimental methods in the study of motivation conflict, learning, forgetting and fatigue.

570. **Methods and Materials for Teaching Safety and Accident Prevention.** (0-3-0) Cr. 3. SS. Mr. Lauer
Prerequisite: 470, 474.
Preparation for teaching in the field of safety; effective methods and suitable materials for producing the background and motivation essential to accident prevention at various educational levels.

574. **Seminar. Psycholcgy of Safety.** (0 2 0) Cr. 1. S.SS. Mr. Lauer
Prerequisite: 9 credits in psychology and education; permission of head of department.
Review of literature in field of safety; presentation of reports based upon reading and research.

596. **Seminar in Applied Psychology.** (0-2-0) Cr. 1 each time elected. F.W.S.
Prerequisite: 9 credits in psychology and permission of head of department.
Messrs. Bath, Ellis, Evans, Fritz, Husband, Lauer, McHugh, Owens, Vance
Required of all graduate majors as long as so classified; required of graduate minors (in residence), for a period of one year. Research reports, reviews of current experimental and theoretical literature, discussion and evaluation.

Courses for Graduate Students

620. **Research.**
Messrs. Evans, Fritz, Husband, Lauer, Owens, Vance

624. **Research Methods in Psychology.** (0-3-0) Cr. 3. F. Mr. Owens
Principles and logic of science as applied to psychology; design of psychological experiments.

638. **Internship in Student Personnel.** (0-2-7) Cr. 3. F.W.S. Mr. Owens
Prerequisite: 539.
Supervised practice in the guidance applications of testing, interviewing and counseling; weekly evaluative clinics.

Radio and Television Education

Advisory Committee: JOSEPH H. NORTH, Ph. D., Chairman, Coordinator of Radio and Television Education

W. L. Cassell, M.S.; C. R. Elder, B.S ; Rodney Fox, M S.; J. A. Greenlee, Ph.D.; R. M. Hixon, Ph.D.; Richard B. Hull, B.S.; F. W. Lorch, Ph. D.; K. R. Marvin, M.S.; Paulena Nickell, Ph.D.; Edith Sunderlin, M A ; G. R. Town, D. Engr.; Albert Walker, Ph.D.

Iowa State College, a pioneer in educational broadcasting, has owned and operated its own non-commercial radio facilities since 1922. The College station, WOI, has served as one of the major agencies of off-campus and extension education throughout Iowa and surrounding states.

A frequency modulation station, WOI-FM, began operation in 1949. With construction of WOI-TV in 1950, the College became the first educational institution in the United States to operate its own television station

Courses in programing, production and writing for both the professional and non-professional student are offered in a joint sequence through the department of English and Speech, and of Technical Journalism in cooperation with the radio station. Related courses will be found in the departments of Applied Arts, Architecture, Electrical Engineering, Music, Physics, Psychology, Statistics and Vocational Education. A complete program in radio and TV engineering for the technical student is provided in the electrical engineering curriculum.

Undergraduate students who desire radio and television training may arrange a sequence of subjects to prepare themselves for this work by consulting with the coordinator of radio and television education and the professor in charge of their major concentrations. In the Division of Agriculture, each curriculum contains sufficient electives to provide this training, particularly agricultural journalism. Each curriculum in the Division of Home Economics contains enough electives for this training, especially the non-professional curriculum in general home economics In the Division of Engineering, the requirements for technical electives

are stringent; the student interested in radio or television training should consult with the head of his chosen department. The curriculum in science offers opportunity for this training either as a complementary part of the area of major concentration or as fields within the major in general science.

Education beyond the fundamental courses is available for qualified students who demonstrate special aptitudes as farm, women's or science editors, news editors, program directors, station engineers and teachers. In combination with work in departmental fields, students may qualify for advanced graduate degrees.

Further information regarding radio and television education may be obtained from Dr. Joseph H. North, Coordinator of Radio and Television Education, Beardshear Hall, Ames, Iowa.

Religious Education

ROY EMANUEL LEMOINE, S.T.B., Head of Department

Assistant Professor: Emerson Wayne Shideler, Ph.D.

Philosophy and religion are concerned with unifying the findings of various sciences with information from other areas of investigation. The courses in the department are concerned with assisting in the development of a reasoned, unified, and comprehensive philosophy of life.

Course 260 is particularly recommended for those who desire a survey course in philosophy and religion and whose schedules will permit only one course in the department. Course 370 is recommended to those desiring to improve their reasoning skills in any field.

Religious vocations: There are increasing opportunities in the religious field for men and women with technical training in certain branches of engineering, home economics, agriculture and the social sciences. However, students planning graduate study to prepare themselves for professional religious service are advised to consult the school of their choice as to the necessary additional undergraduate preparation. The courses listed below are among those most commonly recommended, and students planning to pursue graduate study are advised to include as many as possible.

Economics 261, 262, 263, 384D; Sociology 234*, 319; English 254*, 256, 304*, 354, 484; History 311*, 312*, 313; Psychology 204, 315, 334, 440; Religious Education 260*, 329*, 370*, 441*, 442, 457; Speech 311. 336.

Description of Courses

Courses Primarily for Undergraduate Students

260. **Ideas Men Live By.** (0-3 0) Cr. 3. F.W.S.
Introduction to the living issues of philosophy in the ethical, social, scientific, religious and speculative fields.

321. **Introduction to the Old Testament.** (0 3-0) Cr. 3. F.S.
Major books in the old testament within the framework of their historical background with particular attention to the development of the great religious and ethical ideas.

322. **Introduction to the New Testament.** (0 3 0) Cr. 3. F.W.S.
Major books and themes in the new testament, with particular reference to the social and ethical teachings of Jesus.

329. **Religions of Mankind.** (0 3-0) Cr. 3. F.S.
Designed to stimulate sympathetic exploration of religion through acquaintance with historical development and character of world's chief religions, including Zoroastrianism, Hinduism, Buddhism, Confucianism, Taoism, Shinto, Judaism, Mohammedanism, and Christianity.

*Recommended.

356. **Old Testament.** (Engl. 356) (0-3-0) Cr. 3. W.
Prerequisite: Engl. 108.
Literature of Old Testament, including narrative, poetry, wisdom literature, and prophetic literature.

370. **Introduction to Reflective Thinking.** (0 3 0) Cr. 3. F.W.S.
The discipline of logical thought: examination of the methods of reasoning, laws of reflective thought, and the relation of objective thought to value judgment; practice in analysis of types of reasoning.

421. **Christianity—The First Five Centuries.** (0-2-0) Cr. 2. F.
The rise and spread of Christianity and the Christian Church with particular reference to the development of Christian thought. Readings in the early Christian literature.

422. **Christianity—Medieval and Eastern.** (0-2-0) Cr. 2. W.
Christianity as the framework of society. Examination of the Medieval Synthesis and the Byzantine Church State. Development of Christian art and thought in the Middle Ages

423. **Christianity—The Reformation and After.** (0-2-0) Cr. 2. S.
Examination into the causes and the results of the Protestant Revolt and the Counter Reformation with reading in the contemporary documents. Christianity since the Reformation; modern theological movements; the Ecumenical Movement.

431. **Ethics and Moral Philosophy.** (0-2 0) Cr. 2. W.
Prerequisite: 260.
Various ethical systems and the problems of right conduct: Hedonism, Idealism, Christianity. Discussion on the problem of moral choice in contemporary American life.

437. **Types of Philosophy.** (0 2-0) Cr 2. W.
Prerequisite: 260.
Inquiry directed toward building a working philosophy of life through discussion of various systems of thought. Consideration of philosophical problems that arise in student experience and thought.

441. **History of Philosophy—Ancient and Medieval.** (0-2-0) Cr. 2. F.
Introduction to the history of ancient and medieval thought. Readings in Aristotle, Plato, Seneca, Aurelius, Augustine, Abelard and Aquinas.

442. **History of Philosophy—Modern.** (0-3-0) Cr. 3. W.
Introduction to the history of modern thought. Readings in Descartes, Spinoza, Hobbes, Locke, Hume, Rousseau, James, Hocking, Bergson, Dewey, Whitehead.

443. **Contemporary Social Philosophy.** (0-2 0) Cr. 2. S.
Prerequisite: 442.
Current political and social thought; freedom, the individual and the state; economic aspects of social philosophy. Readings in Marx, J. S. Mill, Hegel, Dewey, Nietzsche, Berdyaev, Maritain, Mannheim.

456. **Psychology of Religion.** (0-2-0) Cr. 2. F.
Prerequisite: 329, Psych. 204.
James, Jung, Freud, Menninger. Problems of integration from viewpoint of religion. Psychological types of religious experience

457 **Philosophy of Religion.** (0-2 0) Cr. 2. S.
Prerequisite: 260, 329
Intended to give acquaintance with contemporary religious thought and to encourage deeper reflection upon such questions as basis of religious knowledge, nature of theistic belief, place of Jesus Christ, problem of evil, and evidences of immortality.

Science

HAROLD V. GASKILL, Ph.D., Dean

J. A. GREENLEE, Ph.D., Assistant to the Dean

FRANK E. BORTLE, Ph.D., Assistant to the Dean

Opportunities for Undergraduate Study

For undergraduate curriculum in science leading to the degree of Bachelor of Science, see page 143.

The curriculum in science is planned to meet the needs of the following classes of students:

Those who are interested in science as related to the practical aspects of industry, commerce, agriculture, engineering, home economics, and veterinary medicine.

Those who desire thorough, fundamental preparation for research in the sciences or for teaching the sciences at the secondary and collegiate levels.

Those who have not made a definite decision as to their vocation, and who desire an education that is strong and well-balanced in the sciences and general studies as a foundation for further scientific or professional study, or as a preparation for intelligent citizenship.

Description of Courses

Course Primarily for Noncollegiate Students

10. **Learning Skills.** (0-3-0) Cr. 5. F.W.S.
Prerequisite: Permission of Dean of Junior College.
Principles of efficient study. Application to current course work.

Courses Primarily for Undergraduate Students

100. **Adjustment to College.** Required. (1-0-0) F.
Lectures designed to aid first year Science students in adjusting to environment of college and life. Presentation of academic and vocational requirements within science curriculum. Personal, social, and occupational relationships in personality development.

417. **Directed Observation and Supervised Teaching in the Sciences.** (V.Ed. 417) Cr. 5. F.W.
Prerequisite: Psych. 334, 434; V.Ed 305, 426; Engl. 394 or Math. 497 or Sci. 486 or 496; permission of the dean; advance reservation required.
Observation, evaluation of instruction, lesson planning, and teaching in the sciences.

486. **Methods of Teaching Science.** (0-3 0) Cr. 3. W.
Prerequisite: 15 credits in subject matter field; permission of the dean

496. **Methods of Teaching Social Studies.** (0-3-0) Cr. 3. S.
Prerequisite: 15 credits in subject matter field; permission of the dean.

Sociology

For description of courses, see Department of Economics and Sociology, courses in Sociology, page 220.

Soils

For description of courses, see Department of Agronomy, courses in Soils, page 170.

Speech

For description of courses, see Department of English and Speech, courses in Speech, page 231.

Statistics

THEODORE A. BANCROFT, Ph.D., Head of Department

Professors: Paul G. Homeyer, M.S.; Raymond J. Jessen, Ph.D.; Oscar Kempthorne, M.A.; George Waddel Snedecor, M.A.; Gerhard Tintner, Ph.D.

Associate Professors: Emil Henry Jebe, Ph.D.; Norman V. Strand, M.S.; Pei Ching Tang, Ph.D.

Assistant Professors: Stanley L. Isaacson, Ph.D.; Richard McHugh, M.A.; Campbell C. Mosier, B.S.; Bernard Ostle, Ph D.

Instructors: Bozivich, Clem, Graybill, Huntsberger, Monroe, Ross, Tandon, Thompson

Opportunities for Undergraduate Study

For the undergraduate curriculum in science, major in statistics, leading to the degree of Bachelor of Science, see page 145

The curriculum in science with a major in statistics is designed to prepare students for work on the following fields: Grade GS-7 statistician in the United States Civil Service, direction of clerical workers and computers engaged in the routine analysis of data, performance of statistical investigations for administrators and executives, assistants to research workers in various areas of science and industry, junior quality control engineers. Undergraduate majors in this department usually include the following basic courses in their programs: 301, 302, 327, 341, 342, 401, 402. As supporting work, undergraduate majors have found the following courses desirable: Math. 101, 102, 103, 211, 212, 213. These lists of courses are not to be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given here solely for the convenience of students or counsellors who wish to estimate the amount of basic, non-specialized study which may be needed.

Some of the following courses might be elected by students intending to pursue careers in:

(1) Government or administrative departments of business and industry: 421, 481, 482, and 524; (2) industrial quality control: 411, 431, 438, 511, 512, 531 and 532; (3) social science research agencies: 421, 438, 522, 524, and 538; (4) agricultural, biological or medical research organizations: 411, 511, 512, 535 and 536; (5) engineering research organizations: 411, 431, 511, 512, 531 and 532; (6) industrial research in advertising, market analysis, or consumer preference: 421, 438, 522, 524, and 538.

Students intending to do graduate work in statistics would normally elect 541, 542, 543 in preference to 446, 447, 448 and would choose electives from 421, 511, 512, 522 and 524.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in statistics, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of an undergraduate curriculum essentially equivalent to the curriculum in Science at this institution together with fifteen credits in statistics and mathematics including one year of calculus.

Open to graduate students for minor credit only: 401, 402, 411, 421, 431, 438, 446. 447, 448, 481, 482.

Description of Courses

Courses Primarily for Undergraduate Students

301, 302. **Principles of Statistics.** (0-2-3) Cr. 3 each. F.W.
Statistical concepts in modern society; averages, variation, probability; elements of statistical inference; statistical surveys and experiments.

327. **Elementary Business Statistics.** (0-3-0) Cr. 3. S.
Prerequisite: 302 or 401.
Applications of statistical principles to business; forecasting, quality control, market research. Methods of presenting statistical material.

341, 342. **Introduction to Theory of Statistics.** (Math. 341, 342) (0-3-0) Cr. 3 each. F.W.
Prerequisite: Math. 212.
Probability; parent population distributions and their descriptive properties; derived sampling distributions; point and interval estimation; regression and correlation; tests of hypotheses.

401, 402. **Statistical Methods for Research Workers.** (0 3-3) Cr. 4 each.
401. F.W.
402. W.S.
Prerequisite: 302 or graduate classification.
The role of statistics in research. Introduction to the methods of analyzing data from experiments and surveys.
(401) Statistical concepts and models; simple tests of significance; linear regression and correlation; introduction to analysis of variance.
(402) Methods of analysis of variance and covariance; analysis of components of variance; introduction to multiple regression, covariance and correlation, both linear and non-linear.

411. **Experimental Designs for Research Workers.** (0-3-0) Cr. 3. S.
Prerequisite: 402.
Methods of constructing and analyzing designs for experimental investigations; randomized block, Latin-square, simple and partially confounded factorial designs, incomplete block designs; treatment of missing data; techniques of experimentation.

421. **Survey Designs for Research Workers.** (0-3-0) Cr. 3. S
Prerequisite or corequisite: 402.
Methods of constructing and analyzing designs for survey investigations; simple random, stratified, multistage and multiphase sampling designs; questionnaire construction; methods of estimation; techniques of survey investigation.

431. **Elementary Statistical Quality Control.** (0-3-0) Cr. 3. S
Prerequisite: 302 or 401 or Gen.E. 362.
Application of statistical principles to manufacturing. Survey of control chart technique and sampling inspection schemes now in use.

438. **Economic Statistics.** (0 3-0) Cr. 3. (Ec. 438) S.
Prerequisite: 401, Ec 408.
Methods of dealing with economic variables; application of regression methods; structural economic relations (production functions, demand functions, cost functions).

446, 447, 448. **Statistical Theory for Research Workers.** (0-3-0) Cr. 3 each. Yr.
446. *Prerequisite:* Graduate classification and one year of college math.
447. *Prerequisite or corequisite:* 402 and either 446 or Math 212.
448. *Prerequisite:* 447.
Primarily for graduate students not majoring in statistics. Emphasis on the aspects of the theory underlying statistical methods. Probability, population distribution functions and their properties, sampling distributions, orthogonal linear functions linear and multiple regression, estimation, tests of hypotheses.

481, 482. **Processing of Data.** (0-1-3) Cr. 2 each. W.S.
Prerequisite or corequisite: 401, 402.
Typical problems in general statistical methods; utilization of punched card and various calculating machines.
(481) Operation and application to statistical problems including regression and multiple classifications in analysis of variance.
(482) Application to statistical problems in serial correlation, processing of survey data.

499. **Special Problems.** Credit as arranged.
Prerequisite: 15 hours in statistics.
For advanced undergraduate students.

Courses for Advanced Undergraduate and Graduate Students

501. **Psychological Statistics.** (Psych. 501) (0 3 0) Cr. 3. S.
Prerequisite: 402. Mr. McHugh
Rank correlation methods; topics in multivariate analysis, including multiple regression, canonical correlation, generalized T, discriminant functions and introduction to factor analysis

504. **Statistical Methods.** (0-3-0) Cr. 3. F.
Prerequisite: 302. For graduate majors in statistics. Mr. Homeyer
Role of statistics in research. Statistical inference, estimation, tests of hypotheses, simple and multiple regression and correlation. Analysis of variance and covariance, components of variance and transformations.

511, 512. **Design of Experiments.** (0-3-0) Cr. 3 each. W.S.
Prerequisite: 402 or 504. Mr. Kempthorne
Principles of statistical design for experimental investigations in biological, agricultural and industrial research; tests; estimation; randomized blocks; Latin-squares; Graeco-Latin squares; 2^n, 3^n and other factorial systems; simple split-plot-trials; introduction to quasifactorial and incomplete block designs.

522. **Design of Surveys.** (0-3-0) Cr. 3. W.
Prerequisite or corequisite: 421 or 504. Mr. Jessen
Principles of statistical design for survey investigations in social, economic, agricultural and market research; formulation of plans for statistical surveys; elementary systems of sampling; choice of type and size of sampling unit; methods of making observations or measurements; methods of eliciting and reporting information; methods of estimation; costs; use of time and resources; determination of degree of accuracy required.

524. **Elementary Theory of Sampling.** (0-3-0) Cr. 3. S.
Prerequisite or corequisite: 448 or 542. Mr. Jessen
Mathematical development of elementary sampling theory. Random, stratified and multistage sampling with equal probabilities. Principles of efficient estimation.

531. **Industrial Statistics: Sampling Inspection.** (0-3-0) Cr. 3. F.
Prerequisite: 342 or 448. Mr. Ostle
Control of quality manufactured products; sampling inspection; single, double and sequential plans; cost functions.

532. **Industrial Statistics: Design of Experiments.** (0-3-0) Cr. 3. W.
Prerequisite: 402, 531. Mr. Ostle
Principles and methods of designing industrial experiments Methods of analysis

535. **Biological Statistics.** (0-3-0) Cr. 3. W.
Prerequisite: 402. Mr. Kempthorne
Biological assay; quantal responses; dosage-mortality relationships; contagious distributions; estimation of bacterial populations; negative binominal distribution; analysis of populations.

536. **Genetic Statistics.** (Gen. 536) (0-3-0) Cr. 3. F.
Prerequisite: 402, 448, Gen 300 Mr. Kempthorne
Statistical estimation, quantity of information, and tests of hypotheses in genetic experiments

538. **Elementary Econometric Statistics.** (Ec. 538) (3-0-0) Cr. 3. S
Prerequisite or corequisite: 448, Ec. 408.
Theory of estimation of structural economic relations in simultaneous equation systems, large sample theory and computation techniques; testing of hypotheses.

541, 542, 543. **Theory of Statistics.** (Math. 541, 542, 543) (0-3-0) Cr. 3 each. Yr.
Prerequisite or corequisite: 342, Math. 514, 515. Mr. Bancroft
Development of distribution theory from the theory of probability; common distribution functions, derivation of sampling distributions with particular attention to normal populations; estimation by maximum likelihood; likelihood ratio tests of parametric hypotheses; introduction to general linear hypothesis theory; elements of sequential analysis; distribution free methods.

599. **Special Topics.** Credit as arranged.
A. Theory.
B. Methods.
C. Design of Experiments.
D. Design of Surveys.
Messrs. Bancroft, Homeyer, Isaacson, Jessen, Kempthorne, Ostle, Snedecor, Tang, Tintner

Courses for Graduate Students

601. **Seminar on Statistical Methods.** Credit as arranged.
Prerequisite: 504, 543.

611, 612. **Advanced Design of Experiments.** (3-0-0) Cr. 3 each.
Prerequisite: 512, 543. Mr Kempthorne
Method of least squares: general theory of factorial designs, fractional replication, theory of quasifactorial and incomplete block designs; split-plot confounding; analysis of groups of experiments; design and analysis of rotation and other long-term experiments.

616, 617. **Probability.** (Math. 616, 617). See Mathematics.

621. **Seminar on Design of Surveys.** Credit as arranged
Prerequisite: 522, 524. Mr. Jessen

624. **Advanced Theory of Sampling.** (0-3-0) Cr. 3. W.
Prerequisite: 524, 543. Mr. Tang
Mathematical development of sampling theory for more complex cases Unequal probabilities of selection. Cluster sampling.

638. **Advanced Econometric Statistics.** (Ec. 638) (0 3-0) Cr. 3. F.
Prerequisite: 538, 543.
Distribution theory of autogressive multiple equation systems; identification problems; applications to prediction and economic policy.

641, 642, 643. **Advanced Theory of Statistics.** (Math. 641, 642, 643) (3-0-0) Cr 3 each. Yr.
Prerequisite: 543, Math. 404, 611. Messrs. Kempthorne, Isaacson
(641) General Theory of Linear Hypotheses: General linear hypotheses; estimation of parameters; tests of hypotheses; development of analysis of variance and covariance for multiple classifications from general linear hypotheses with application to some experimental designs.
(642) Distribution Theory: Postulational development of probability and distribution functions; operations on characteristic functions; asymptotic distributions.
(643) Theory of Estimation and Testing of Hypotheses: Neyman-Pearson theory of testing hypotheses; point and interval estimation, introduction to Wald theory of decision functions.

646. **Time Series.** (Math. 646, Ec. 646) (0 3 0) Cr. 3. Alt. S. Offered 1953
Prerequisite: 402 or 504, Math. 213, Ec. 408. Mr. Tintner
Random elements; variate difference method; seasonal variations; cyclical variations; Fourier series, harmonic analysis; trend; orthogonal polynomials, correlation, economic application of multivariant analysis.

647. **Multivariate Analysis.** (Math. 647) (3 0-0) Cr. 3.
Prerequisite: 543, Math. 605.
Conditional and marginal distributions; properties of multivariate normal distribution; Wishart distribution, generalized T^2; likelihood ratio criterion, multivariate regression analysis; elementary discriminant functions.

648. **Sequential Analysis.** (Math. 648) (3 0 0) Cr. 3.
Prerequisite: 543.
Sequential estimation and tests of hypotheses; sequential probability ratio test; application to normal, binomial and Poisson distribution.

688. **Seminar on the Theory of Statistics.** (Math 688) (3 0 0) Credit as arranged.
Prerequisite: 543.

699 **Research.**

Messrs Bancroft, Jessen, Kempthorn, Snedecor, Tang, Tintner

Technical Journalism

KENNETH R. MARVIN, M.S., Head of Department

Professor: Rodney Fox, M.S.

Associate Professor: Richard B Hull, B S.

Assistant Professors: Dwight Murdoch Bannister, B.S.; *Harry E Heath, M.S.; Ellen Pennell, B.S.; James W. Schwartz, B S.

Instructors. Ames, Haws

Lecturer: John M. Carter, M.A.

Opportunities for Undergraduate Study

For undergraduate curricula in agricultural journalism and in home economics or science, major in technical journalism, leading to the degree of Bachelor of Science, see pages 95, 138 and 145 respectively For a sequence in radio and television see page 297.

Instruction in technical journalism is offered to all students and adapted as far as possible to their various needs. Its purpose is two-fold: to serve those professionally interested in technical journalism and to aid those wishing less extensive work.

To professional students it offers training for editorial positions with the technical, business, and trade press, for advertising positions with such publications

*On leave

and with industries, for similar positions in radio and television, and for rural community journalism.

A sequence of suggested courses designed to prepare students for outdoor writing will be supplied upon request. This sequence combines courses in journalism, wildlife, range management, conservation and other natural resources. Students may take major work in either zoology and entomology, forestry, or technical journalism with minor work in the other fields

Students are expected to maintain an average of not less than B in senior college technical journalism courses in order to continue in these curricula. Engineering students may elect a sequence of courses in technical journalism. Selection from the following courses is recommended: T.Jl. 222, 225, 325, 335, 341 or 342, 451D, 475; Sp. 301. Because of the desirability of combining a sequence of courses with work on student publications, it is recommended that interested students begin their journalism work in the sophomore year where possible.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in technical journalism and minor work to students taking major work in other departments.

To qualify for major work a student must have completed a curriculum leading to a Bachelor of Science degree, including a minimum of 12 hours of journalism, or an undergraduate curriculum in journalism substantially equivalent to that offered at this institution.

Open to graduate students for minor only: 430, 445, 446, 465, 475, 482.

Description of Courses

Course Primarily for Noncollegiate Students

25. **Livestock Advertising.** (0-2 0) Cr. 2 W.
Advertising as related to livestock selling

Courses Primarily for Undergraduate Students

110 **Journalistic Vocations.** (0 2 0) Cr. 2 S.
Orientation in agricultural and technical journalism

221, 222, 223. **Technical Writing.** (2 0 3 to 12) Cr. 1 to 6 each Yr.
Prerequisite: Engl. 103.
It is highly desired that students have some proficiency in personal typing.
News values, news style, news gathering and writing, history of technical journals. Field trips.

225. **Beginning Technical Journalism.** F.W.S
225. (0-8-0) Cr. 8.
225B. For home economics students. (0 3 0) Cr. 3
225C. For physical education students. (0 3 0) Cr. 3 S
Prerequisite: Engl. 103
News values, news gathering and writing, with special reference to technical subject matter. Use of communication mediums for public relation purposes.

317. **Photography in Journalism.** (Phys. 317) See Physics.

325. **Technical Advertising.** (0 2 0) Cr. 2 or 3 F.S
For students other than those professionally interested in advertising. Conference

326 **Radio and Television Advertising.** (0 3 0) Cr. 3 W.
Principles of advertising as applied to radio and television. Conference.

335 **Feature Articles for Technical Journals.** (0-8 0) Cr. 8. W
Prerequisite: 225
Writing of magazine articles dealing with agriculture, engineering, home economics, or science

. . . . . .

341, 342, 343. Practice in Copy Editing and Typography. (0 0-6) Cr. 2 each. Yr
342B, 343B. For home economics students.
Prerequisite: 222 or 225.
Copy editing, headline writing, and make-up. Type, type setting, and design of printed matter. Trips to graphic arts plants.

426, 427. Technical Writing. (0 2-3 to 9) Cr. 1 to 5 each. F.W.
Prerequisite: 222. Home economics students should have completed all required work in foods, equipment, clothing and child development.
Gathering of material and preparation of articles for technical magazines.

430. Law of Communications. (0 3 0) Cr. 3. F.
Prerequisite: 222.
Libel, slander, lottery, copyright; postal laws; the Federal Communications Act; laws affecting advertising and legal publications.

445, 446. Technical Advertising. (0-3 0) Cr. 3 each F.W.
Prerequisite: 225 or equivalent.
Fundamental principles and practice of advertising. Layout, copywriting, publication promotion.

451, 452, 453 Management of Technical Journals. (0 2-0) Cr. 2 each Yr.
Prerequisite: Engl. 103.
A. For Agricultural students.
B. For Home Economics students.
C. For Science students.
D. For Engineering students.
Workshop in editorial, advertising, and circulation management problems; publishing four monthly magazines as laboratory projects.

464 Rural Community Newspaper. (0 3-0) Cr 3 Alt. S. Offered 1953
Prerequisite: 223 or equivalent.
Editorial, advertising, circulation, and management problem of rural community newspaper.

465. Mechanics of Printing and Illustrating. (0 3 0) Cr 3. Alt. S. Not offered 1953
Prerequisite: 223 or 335.
Study of mechanical phases of making of newspaper or technical journal.

475 Radio and Television Writing. (0 3 0) Cr. 3 W.
Prerequisite Sp. 302
Elements of continuity writing, plugs, commercial messages, script forms; interview scripting, writing the variety show, the rural talk standard script procedures.

481 Radio News Writing. (0 1 3) Cr 2 F.S
Prerequisite 225, Sp 302
Fundamentals of writing and editing news for broadcasting

482 Radio News Program Building. (0 1 3) Cr 2 W.
Prerequisite 481
Radio news program patterns and the techniques of building radio news programs. Qualified students will write and present news broadcasts for Radio Station WOI and WOI FM

Courses for Advanced Undergraduate and Graduate Students

510 Reader and Audience Analysis. (0 3 0) Cr 3 Alt. W. Not offered 1953
Prerequisite 223 or 475 Mr. Marvin
Reader interest surveys Application of understandability formulas Public opinion polls. Measuring influence.

515 Public Relations. (0 3 0) Cr 3 Alt. S. Not offered 1953
Prerequisite 225 Mr. Fox
Utilization of various mediums of public information for promotion of specific objectives

517. Pictorial Communication. (0-2 3 to 9) Cr. 1 to 5 Alt F. Not offered 1952
Prerequisite: 222, 317. Mr. Fox
A survey of the uses in communication of photographs, drawings, graphs, charts, maps and nonword symbols Special emphasis on how to communicate by means of pictures.

525 Presentation of Economic Information. (Ec. 525) (0 3 0) Cr. 3. W
Prerequisite: 225, Ec. 407. Mr. Kutish
Sources and channels of economic information; mediums, language and interpretation of economic analysis, writing skills.

526, 527 Technical Writing. (0-2-3 to 9) Cr. 1 to 5 each F.W.
Prerequisite: 223 Miss Pennell
Gathering of material and preparation of articles for technical magazines.

528 Advanced Technical Writing and Editing. (0 2-3 to 9) Cr. 1 to 5. S
Prerequisite: 427. Miss Pennell
Writing and editing of technical material for magazines, journals, special publications and books.

531. **History of Journalism.** (0-2 3 to 9) Cr. 1 to 5. W.
Prerequisite: 222. Mr. Fox
Development of American journalism from colonial times. Emphasis on growth of freedom of the press concept, ethical standards and role of the press in growth of American culture.

532. **Literature of Communication.** (0 2-3 to 9) Cr. 1 to 5. S.
Prerequisite: 222. Mr. Fox
A survey of the literature concerning communication with special emphasis placed on controversies within and about journalism in its broad definition.

576. **Broadcasting for Special Audiences.** (0 2-3) Cr. 3. S.
Prerequisite: 223 or 225, Sp. 302. Mr. Hull
Study of farm, home, and industrial radio audiences with regional and area differences; specialized types of information, and their presentation. Advanced instruction in scripting and broadcasting. Enrollment limited.

583 **Specialized News Broadcasting.** (0-1-3) Cr. 2. F.S.
Prerequisite: 482. Messrs. Heath, Schwartz
Various specialties in the news broadcasting field and the preparation of specialized news programs. Qualified students will write and present news broadcasts for Radio Station WOI and WOI-FM.

590. **Special Topics.** Credit as arranged.
A. Technical Journalism Miss Pennell, Messrs. Fox, Marvin
B Radio and Television. Miss Pennell, Messrs. Heath, Hull, Schwartz

Courses for Graduate Students

650 **Seminar. Required** Messrs. Fox, Marvin

690 **Research.** Messrs. Fox, Marvin

Textiles and Clothing

PAULENA NICKELL, Ph.D, Acting Head of Department

Professors: Rosalie Rathbone Craft. M A.; Iva L. Brandt, M.S.

Associate Professors: *Fannie Potgieter, M A ; O Settles, B.S ; Marie Stephens. B.S.

Assistant Professors. Karlyne Alice Anspach. M A ; Lillian Elizabeth Brehm, M.A ; Irene Hayes Buchanan. M.S ; Norma R. Hollen, M.S.; Harriet Tilden McJimsey. M A ; Lucille Emma Rea, B S ; Opal M. Roberson, M.A ; Jane Saddler, M.S.

Instructors Criss. Davison. McCart

Opportunities for Undergraduate Study

For undergraduate curricula in textiles and clothing and in textiles and related science leading to the degree of Bachelor of Science, see pages 137 and 141.

The department offers courses designed to furnish such knowledge and training as is essential to the consumer for satisfactorily providing clothing and household fabrics for the individual, the family, and the home.

Advanced work is also offered to provide fundamental information and training in textiles and clothing for those who wish to go into merchandising or other commercial positions which involve work in textiles, clothing, costume design, or fashion.

The curriculum in textiles and related science is designed for those who wish to prepare to work in textile laboratories or to do research in textiles.

*On leave

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science, and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of courses in economics; chemistry (including inorganic, organic and textile; physics; applied art (including drawing, composition and design); textiles and clothing (including specific courses in general textiles, clothing construction and costume designing). Additional prerequisites may be required, depending upon the nature of the work the student wishes to pursue.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: 444, 464, 466.

Description of Courses

Courses Primarily for Undergraduate Students

145. **Costume Design and Selection.** (1-0 6) Cr. 4. F.W.S.
Essentials of designing and selection of costumes for becomingness to types of people and to individuals.

204. **General Textiles.** (0 0 6) Cr. 3. F.W.S.
Prerequisite: Chem. 105 or 101.
Fundamental weaves, yarns, fibers, color and finishes with reference to selection of fabrics for clothing and house

224 **Elementary Clothing Construction.** (0 0-9) Cr. 3. F.W.S.
Prerequisite: 145.
Use of commercial pattern, basic garment construction; fabrics in relation to pattern designs, construction for specific fabrics and designs. Students will be sectioned according to ability as indicated in a pretest in sewing skills.

324 **Advanced Clothing.** (0 0 9) Cr. 4. F.W.S
Prerequisite: 224.
Development of foundation pattern; flat pattern designing; making pattern for selected dress design and developing in wool material.

444 **Costume Design.** (0 0 6) Cr 3 F.S
Prerequisite: 224, A.A. 103
Creative problems based on source material commonly used in designing clothing.

464 **Textile Purchasing.** (0 2 0) Cr 2 W
Prerequisite: 204, Ec. 213.
Problems of production and distribution of textile and clothing commodities which directly or indirectly affect consumers.

466 **Retailing.** (Ec 466) See Economics.

490 **Special Problems** F.W.S
Prerequisite Permission of the head of the department

Courses for Advanced Undergraduate and Graduate Students

504. **Advanced Textiles.** (0-3 0) Cr. 3. F.S.
Prerequisite: 204, Chem 264. Misses Hollen, Saddler
New developments affecting characteristic behavior of old and new fiber as reported in current literature

514 **Historic Textiles.** (0 0 6) Cr. 3. F.W.
Prerequisite: 504, Hist 213 Miss Settles
Development of textiles from ancient times; existing sources; comparison with modern commercial products.

524. **Applied Dress Design.** (0 0 6) Cr. 3. F.W S
Prerequisite: 824. Miss Potgieter
Draping and modeling dresses, with emphasis upon handling different fabrics and finishing techniques.

525. **Adanced Applied Dress Design.** (0 0-6) Cr. 3. Alt. W. Offered 1953
Prerequisite 524 Miss Potgieter
Pattern requirements of designs in different materials; different types of costumes.

526. **Children's Clothing.** (0 0 6) Cr. 3. S.
Prerequisite: 324. Misses Brandt, Potgieter
Patterns, selection, and construction of suitable clothing for children.

527. **Tailoring.** (0 0 9) Cr. 4. F.W.S.
Prerequisite: 324. Miss Stephens
Tailoring construction applied in making coats and suits

544. **Costume Design.** (0 0 6) Cr. 3 Alt. W. Offered 1953
Prerequisite: 444, A.A. 212. Mrs. Craft
Selection and creative problems, with emphasis upon detail.

554. **History of Costume.** (3 0 0) Cr. 3. F.W.
Prerequisite: Hist. 213. Miss Potgieter

565. **Producing and Distributing Units of Textile Commodities.** (0 2 0) Cr. 2. W.
Prerequisite: Credit or classification in 464. Miss Brandt
Organizations promoting consumer interests; textiles and clothing mills; factories; institutes and retail outlets; their organization and personnel analysis of opportunities open to women.

590. **Special Topics.** F.W.S.
Prerequisite: Permission of the head of the department
A. Textiles. Miss Hollen
B Historic Textiles. Miss Settles
C. Clothing Construction Mrs Buchanan, Misses Hollen, Potgieter, Saddler
D. Costume Design. Mrs. Craft
E History of Costume Miss Potgieter

Courses for Graduate Students

610. **Seminar.** Cr. as arranged F.W.S
Mrs. Craft, Misses Brandt, Settles

614. **Research.** F.W.S
Mrs. Craft, Misses Brandt, Settles

Theoretical and Applied Mechanics

HERBERT JAMES GILKEY, M.S., Sc.D., Head of Department

Professors Stephen Johnes Chamberlain, M S , *Archie Higdon, Ph D , Glenn Murphy, Ph.D.

Associate Professors: Arthur William Davis, Ph.D.; Edward Henry Ohlsen, C.E.

Assistant Professors: Arnold Rufus Livingston, B.S.; Richard Thomas Othmer, M.S.; Aldor Cornelius Peterson, M.S.; Norman John Sollenberger, M S

Instructors: Carnes, Elizondo, Goodstein, Reinhart, *Rowe

Opportunities for Undergraduate Study

The courses in mechanics are intermediate between those in physics and mathematics and the professional and design courses of the several engineering curricula. In the work of this department the student is expected to acquire an elementary conception of the principles underlying the technique of analysis and a knowledge of those properties of materials which influence the manner and extent of their use for engineering purposes. He is expected to gain some insight into the background of purchase and design specifications. Physical properties of engineering materials are studied in the classroom and are evaluated in the laboratory. General laws, such as those of Newton, are given mathematical expression and are made suitable for use in the solution of specific problems in machine and structural design and in the flow and measurement of fluids

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and of Doctor of Philosophy in theoretical and applied mechanics; and minor work to students taking major work in other departments.

*On leave

Prerequisite to major graduate work is the completion of a curriculum substantially equivalent to that required of undergraduate students in engineering at this institution. This should include the undergraduate courses necessary for the particular field chosen.

Open to graduate students for minor only: 324, 327, 344, 354, 358, 378, 444, 484, 498.

Description of Courses

Courses Primarily for Undergraduate Students

274 **Statics of Engineering.** (0-4-0) Cr. 4. F.W.S
Prerequisite: Phys. 221, Math. 212, credit or classification in Math. 213.
Force systems, resultants, equilibrium, friction, centroids, moments of inertia.

324. **Mechanics of Materials.** (0-5-0) Cr. 5. F.W.S.
Prerequisite: 274.
Elements of stress analysis applied to pressure vessels, riveted and welded joints, beams, shafts, springs, columns, including simple stress, combined stresses, deflection, eccentric loading, repeated loading, and impact.

327.* **Materials Laboratory.** (0-0-3) Cr. 1. F.W.S
Prerequisite: Credit or classification in 324.
Experimental determination of physical properties of steel, cast-iron, timber, concrete and/or other engineering materials. Preparation of reports.

344. **Dynamics of Engineering.** (0-4-0) Cr. 4. F.W.S.
Prerequisite: 274.
Moments of inertia of masses. Kinematics: motions of particles and of rigid bodies Kinetics: force, mass, acceleration; work and energy; impulse and momentum.

354. **Engineering Materials.** (0-3-0) Cr. 3. F.W.
Prerequisite: Credit or classification in 324.
Properties, uses and manufacture of metals, timber, stone, clay products, cements, concrete and other engineering materials.

358 * **Engineering Materials.** (0-3-6) Cr. 5. F.W
Prerequisite: Credit or classification in 324
Essentially a combination of 354 and 327 but with added emphasis on concrete. One-day inspection trip.

378. **Mechanics of Fluids.** (0 3-2) Cr. 4. F.W.S
Prerequisite: 344.
Elements of engineering applications of the laws of fluid behavior; statics, kinematics and kinetics of fluids.

444 **Aircraft Vibration and Flutter.** (0-3 2) Cr. 4. W.
Prerequisite: 344.
Elementary vibration analysis with application to aircraft problems. Two-dimensional flutter theory.

484. **Principles of Similitude.** (0-3-2) Cr. 4. S.
Prerequisite: 324.
Dimensional analysis. Principles governing the design and operation of models for the solution of engineering problems. Analogies.

498. **Construction Materials.** (0-1-6) Cr. 3. F.
Prerequisite: 324, 327 and 354 or 358.
Field inspection, sampling, testing methods; advanced studies relating to structural use of such materials as timber, concrete, clay products, and metals. One-day inspection trip.

Courses for Advanced Undergraduate and Graduate Students

500. **Special Topics.** Cr. 2 to 5 each time elected. As arranged.
Messrs Chamberlin, Gilkey, Murphy

514 **Advanced Mechanics of Materials.** (0-3 or 4 0) Cr. 3 or 4. F W.S
Prerequisite: 324. Messrs. Gilkey, Murphy, Othmer
Special problems met in engineering. Limitations of flexure and torsion formulas, unsymmetrical bending, curved beams, combined stresses, theories of failure, thin tubes, thick hollow cylinders, photoelasticity.

515. **Development of Mechanics.** (0-2 to 4 0) Cr. 2 to 4. W
Prerequisite: 324, 344. Messrs. Chamberlin, Gilkey, Murphy
Historical development of the expression of the principles of mechanics.

*327, 358 A student who is not present for the first laboratory meeting of his own section may qualify for continuation in the course only by attending the first laboratory meeting of some other section of either of these two courses.

516. **Advanced Properties of Engineering Materials.**
(0 2 to 4-0) Cr. 2 to 4. As arranged
Prerequisite: 324 and 354 or 358. Messrs. Chamberlin, Gilkey
Properties in relation to use; factors which influence working stresses; basis of standard specifications.

517. **Advanced Mechanics of Materials Laboratory.** (0-0-2 to 4) Cr. 1 or 2. F.W.S.
Prerequisite: Credit or classification in 514. Messrs. Murphy, Othmer
Experimental techniques of stress evaluation; strain measuring equipment, brittle varnish, photoelastic studies. Analogies.

518. **Experimental Stress Analysis.** (0-1-4) Cr. 3. F.S.
Prerequisite: 327 or 358. Messrs. Murphy, Othmer
Modern techniques for experimental determination of stresses in complex members. Strain gages, stress coat, photoelasticity, statiflux, magniflux and ultrasonic analysis.

524. **Advanced Technical Statics.** (0-3 or 4-0) Cr. 3 or 4. W
Prerequisite: 324. Mr. Murphy
Principle of virtual work; moment distribution; column analogy; applications to engineering problems.

544. **Mechanical Vibrations.** (0-2 to 4-3) Cr. 3 to 5. F.S.
Prerequisite: 344, Math. 314. Mr. Murphy
Kinematics of vibrations, equations of motion applied to systems with free and forced vibrations, resonance, viscous and Coulomb damping, multiple degrees of freedom, mobilities, Rayleigh's method. Isolation and absorption of vibrations. Application to engines and rotating machinery, vibration of propellers, aerodynamic flutter.

548. **Advanced Engineering Dynamics.** (0-3-2) Cr. 4. W.
Prerequisite: 344. Messrs. Davis, Murphy
Dynamics of particles and rigid bodies applied to advanced engineering problems Generalized coordinates and Lagrangian equations of motion.

564. **Elastic Stability.** (0-3-0) Cr. 3. W
Prerequisite: 514, Math. 314. Mr. Murphy
Stability of columns, beam-columns, and panels. Assumptions and limitations. Lateral buckling of beams. Torsion of thin-walled members.

568. **Applied Plasticity.** (0-2 or 3-3) Cr. 3 or 4. S
Prerequisite: 514. Mr. Murphy
The plastic state of engineering materials, types of flow, creep and relaxation, redistribution of strain and stress. Engineering applications.

594, 595. **Applied Elasticity.** (0-2 to 4-0) Cr. 2 to 4 each. As arranged
Prerequisite: 324. Mr. Murphy
Fundamental relations of elasticity; uniform and non-uniform states of stress; Airy's function; applications to engineering problems.

Courses for Graduate Students

600. **Research.** Messrs. Chamberlin, Gilkey, Holl, Murphy, Schlick

614. **Analytical Study of Experimental Work in Concrete.**
(0-2 to 4-0) Cr. 2 to 4. As arranged
Prerequisite: 358, C.E. 331. Mr. Gilkey
Interpretative survey of background of present concrete practice.

620. **Seminar.** (1-0 0) Cr. 1.
Messrs. Chamberlin, Gilkey, Murphy

661, 662, 663. **Mathematics of Elasticity.** (Math. 661, 662, 663) See Mathematics.

666, 667, 668. **Static and Dynamic Problems of Plates and Shells.**
(Math. 666, 667, 668) See Mathematics.

684, 685, 686. **Similitude in Engineering.** (0-2 to 3-3 to 6) Cr. 3 to 5 each. Yr
684. *Prerequisite:* 324 and permission of instructor. Mr. Murphy
685. *Prerequisite:* 378, 684.
686. *Prerequisite:* 684.
(684) Use of models as aids to engineering design. Principles of dimensional analysis Design and testing of models; interpretation of data. Application to beams and shafts under static and dynamic loading. (685) Application to problems of fluid flow Hydraulic structures under various conditions of operation. Distorted models. (686) Application to advanced problems in mechanics of elastic solids Dissimilar models. Photoelastic models. Analogies.

Veterinary Anatomy

ROBERT GETTY, Ph.D., Head of Department

Professor: Harry Lewis Foust, D.V.M.

Assistant Professor: Robert P. Worthman, D.V.M.

Instructor: Cowles

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree of Doctor of Veterinary Medicine, see page 150.

Through courses in this department, veterinary students acquire a detailed knowledge of the anatomy of the domestic animals which is necessary for a proper understanding of physiology, pathology, diagnosis, surgery, and medicine.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in microscopic and gross anatomy; and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of an undergraduate curriculum substantially equivalent to that in veterinary medicine.

Description of Courses

Courses Primarily for Undergraduate Students

101, 102, 103. Microscopic Anatomy. Yr.
101. (2-0-9) Cr. 5; 102. (2-0-6) Cr. 4; 103. (1-0-12) Cr. 5.
Prerequisite: One year of college biology.
Cells, tissues, organs, histogenesis, embryogeny, organogenesis, and structure.

111, 112, 113. Gross Anatomy. Yr.
111. (0-0-15) Cr. 5; 112. (0-0-18) Cr. 6; 113. (0-0-12) Cr. 4.
Prerequisite: One year of college biology.
Systematic and topographic study and dissection of horse, ox, sheep, pig, dog, chicken, and laboratory animals.

217. Anatomy of Domestic Animals. (3 0 0) Cr. 3. F.
For students in agriculture and others desiring fundamental knowledge of anatomy.

401. Advanced Anatomy. (0 0 9) Cr. 3 to 5 each time taken. F.W.S.
Prerequisite: 102, 112 or equivalent.
A. Regional systematic and topographic dissections as related to practice of veterinary medicine.
B. Microscopic anatomy and its techniques as applied to organs and systems.

402. Applied Anatomy. (2 0-3) Cr. 3. F.
Prerequisite: Fourth year classification in Vet. Med.
Topographic study of principal surgical and obstetrical regions of domestic animals.

Courses for Advanced Undergraduate and Graduate Students

502. Systematic Anatomy. (1-0-6 or 12) Cr. 3 or 5 each time taken. F.W.S.
Prerequisite: One year of college biology. Mr Getty
Dissection of dog, chicken and other animals.

511. Neuroanatomy. (0 2-6 or 0-2 0) Cr. 2 to 4. W.
Prerequisite: Permission of instructor. Mr. Foust
Central and peripheral nervous system including the organs of special sense.

Courses for Graduate Students

601, 602, 603. Advanced Microscopic Anatomy. Yr.
601. (2-0-9) Cr. 5; 602. (2-0-6) Cr. 4; 603. (1-0-12) Cr. 5.
Prerequisite: One year of college biology. Mr. Foust
Cytology, embryology, and microscopic organology of the animal body.

604. **Seminar.** Cr. 1. F.W.S.
Messrs. Foust, Getty

610. **Anatomy of the Endocrine Organs.** (0-2-3) Cr. 3. S.
Prerequisite: Permission of instructor. Mr. Foust
Embryology and structure of the endocrine organs of domestic animals.

690. **Research.**
A. Gross Anatomy. Messrs. Foust, Getty
B. Microscopic Anatomy.

Veterinary Clinics

See page 339

Veterinary Hygiene

IVAL ARTHUR MERCHANT, D.V.M., Ph.D., Head of Department

Associate Professor: R. Allen Packer, D.V.M., Ph.D.

Assistant Professor: John R. Collier, D.V.M.

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree of Doctor of Veterinary Medicine, see page 150.

The Veterinary Hygiene Department offers instruction in bacteriology, immunology, food hygiene, and in the diagnosis and control of the infectious diseases. The department administers the sanitary control of the milk supply to the city of Ames which furnishes a teaching laboratory in the course in dairy hygiene.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in veterinary bacteriology and veterinary hygiene; major work for the degree of Doctor of Philosophy in veterinary bacteriology; and minor work to students taking major work in other departments.

The research facilities of the Veterinary Research Institute are available to approved and qualified students.

Prerequisite to major graduate work is the completion of an undergraduate curriculum substantially equivalent to that in veterinary medicine.

Description of Courses

Course for Noncollegiate Students

3. **Farm Sanitation and Communicable Diseases.** (2-0-0) Cr. 2. W.
General consideration of the causes and spread of disease; disinfectants and their application; general hygiene and sanitation.

Courses Primarily for Undergraduate Students

224. **General and Pathogenic Bacteriology.** (3 0-9) Cr. 6. (Bact. 224) F.
Prerequisite: Chem. 374, 375 or equivalent
Morphology, classification, and physiological characteristics of pathogenic bacteria; principles of infection and immunity.

225. **Pathogenic Bacteriology.** (Bact. 225) (3-0 6) Cr. 5. W.
Prerequisite: 224, Vet. Path. 254.
Detailed study of bacteria associated with animal diseases.

226 **Virology.** (3-0 3) Cr. 4. S.
Prerequisite: 225, Vet. Path. 254, 255.
The general properties of viruses and characteristics of virus diseases of animals.

420. **Dairy Hygiene.** (2 0 6) Cr. 4. F.W.S
Prerequisite: First 3 years of veterinary curriculum
Study of effect of bovine diseases and sanitation on safety and quality of milk and milk products.

421, 422, 423. **Infectious Diseases.** (4 0 0) Cr. 4 each F.W.S.
Prerequisite: First 3 years of veterinary curriculum.
History, etiology, epidemiology, symptomotology, pathology, diagnosis, control and public health relationships of infectious diseases of animals.

426 **Meat Hygiene.** (3 0 0) Cr. 3. S.
Prerequisite: First 3 years of veterinary curriculum
Organization of federal division of meat inspection, slaughter of meat producing animals, methods of inspection, and rules for disposition of abnormal meat.

427. **Livestock Sanitation.** (3 0-0) Cr. 3. S.
Prerequisite. Bact. 200 or 304
Study of principles of sanitation and methods of controlling common animal infections. Designed for students of animal husbandry and vocational agriculture.

428 **Poultry Sanitation.** (2 0 0) Cr. 2 Alt. S Not offered 1952
Prerequisite: Bact. 200 or 304.
Study of principles of sanitation and methods of controlling common poultry diseases. Designed for poultry husbandry students.

Courses for Advanced Undergraduate and Graduate Students

529. **Immunology.** (3-0 0 or 6) Cr. 3 or 5. S
Prerequisite: 224, 225, Vet. Path. 255, 256. Mr. Merchant
Detailed study of immunity and use of immunizing products in controlling animal diseases.

590. **Special Topics.** Cr. 1 to 5 F.W.S.
Prerequisite: 225. Messrs Merchant, Packer, Schwarte

Courses for Graduate Students

604. **Seminar.** (0-1 0) Cr. 1 F.W.S.
Mr. Merchant

625. **Pathogenic Bacteriology.** (3-0 6) Cr 5. W.
Prerequisite: 224. Mr. Packer
Pathogenic bacteria and the relationship of their metabolism to animal diseases.

626. **Virology.** (3 0 3) Cr 4 S
Prerequisite: 225, Vet. Path 255 Mr. Packer
General characteristics of viruses, technical procedures and specific viruses causing disease in animals.

690. **Research.**
A. General and Food Hygiene Mr. Merchant
B Pathogenic Bacteriology. (Bact 690B) Messrs Biester, Merchant, Schwarte

Veterinary Medicine

CLARENCE HARTLEY COVAULT, D.V.M.

Professor: Chester Daniel Lee. D.V.M., M.S.

Associate Professors: Durwood L. Baker, D.V.M.; John B. Herrick. D.V.M., M.S.

Assistant Professor Maynard Lynn Spear, D.V.M.

Instructors Albrecht, Jensen

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree of Doctor of Veterinary Medicine, see page 150

The study of medicine summarizes and shows the application in practice of the training previously received in anatomy, physiology, pathology, bacteriology,

and therapeutics. On completion of the senior year the student has not only the theoretical knowledge, but some of the most practical methods of applying such knowledge. The transition from the student to the practitioner presents little difficulty after such training.

Description of Courses

Courses Primarily for Undergraduate Students

331, 332, 333. **Medicine.** Cr. 5 each. Yr.
331. (4-0-3) Cr. 5; 332. (5-0-0) Cr. 5; 333 (5-0-0) Cr. 5.
Prerequisite: Vet.Anat. 118, Vet.Hyg. 225, Vet.Path. 256.
Methods employed in diagnosis of animal diseases and consideration of diseases not widely spread.

336. **Small Animal Medicine.** (5-5-0) Cr. 5. W
Prerequisite: Vet.Anat. 118, Vet.Hyg. 225.
Treatment and prevention of diseases of small domestic and furbearing animals.

337. **Small Animal Medicine.** (5-0-3) Cr. 6. S.
Prerequisite: Vet. Surg. 372.
Surgical diseases of dog, cat, small pet animals, and of furbearers.

381, 382, 383. **Clinics.** (0 0 12) Required. Yr.
Concurrent with Vet.Obst. and Vet Surg. 381, 382, 383.

438. **Professional Orientation.** (2 0 0) Cr. 2. S.
Prerequisite: Fourth year classification in Vet. Med.
Professional ethics and other problems of the professional man.

481, 482, 483. **Clinics.** (0 0 18) Cr. 3 each, including Obst. and Surg. Yr.
Concurrent with Vet Obst and Vet.Surg. 481, 482, 483

484. **Clinical Conference.** (0-0-6) Cr. 2. F.
Prerequisite: Credit in 333, 337, 383, Vet.Obst. 345, and Vet.Surg. 373.
Special study of problems in diagnosis and treatment of selected cases.

Veterinary Obstetrics

MACK ALLEN EMMERSON, D.V.M., M.S., Head of Department

Instructor: Reuber

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree of Doctor of Veterinary Medicine, see page 150

The significance of a thorough knowledge of the structure, function and disease processes of the reproductive organs is becoming increasingly apparent. The efficiency of herds and flocks depends upon their ability to reproduce at regular and definite intervals. The Department of Obstetrics presents not only the work in obstetrics but considers the whole reproductive life of domestic animals and emphasizes the cause and prevention of disease processes pertaining thereto.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in veterinary obstetrics with special emphasis on the diseases of reproduction of domestic animals.

Prerequisite to major graduate work is graduation from an approved college of veterinary medicine.

Description of Courses

Courses Primarily for Undergraduate Students

345 **Principles and Practice of Obstetrics.** (4-0 3) Cr. 5. F
Prerequisite: First seven quarters of veterinary curriculum.
Care of pregnant animals. Causes and treatment of sterility.

381, 382, 383. **Clinics.** (0 0 12) Cr R Yr.
Prerequisite: Classification in Vet.Med 331, Vet Obst. 345, and Vet.Surg. 371.
Concurrent with Vet.Med and Vet Surg. 381, 382, 383.

440. **Radiology.** (0 3 0) Cr. 3. W.
Prerequisite: First ten quarters of the veterinary curriculum.
Essentials of radiography and fluoroscopy with particular emphasis on protection from irradiation and on interpretation of radiographs.

444 **Disturbances of Reproduction and Diseases of the Newborn.** (3-0-3) Cr. 4. S.
Prerequisite: 345.
Diseases of the generative organs, their causes, control and treatment.

481, 482, 483. **Clinics.** (0 0-18) Total Cr. 3 each, including Med. and Surg. Yr.
Prerequisite: Fourth year classification in Veterinary Medicine.
Concurrent with Vet.Med. and Vet Surg. 481, 482, 483.

Courses for Graduate Students

604. **Seminar.** Cr. 1. F.W.S.
Mr. Emmerson

644. **Advanced Obstetrics.** (1 1 3 or 9) Cr. 3 or 5. F.W.S.
Prerequisite: 444. Mr. Emmerson
Diseases of reproductive organs of the male.

645. **Advanced Obstetrics.** (1 1 3 or 9) Cr. 3 or 5 F.W.S.
Prerequisite: 444. Mr. Emmerson
Diseases of reproductive organs of the female

690. **Research.** F.W.S.
Mr. Emmerson

A. Diseases of reproduction in the male domestic animal
B. Diseases of reproduction in the female domestic animal
C Diseases of the newborn domestic animal.

Veterinary Pathology

EDWARD ANTONY BENBROOK, V M D, Head of Department

Associate Professor Frank Kenneth Ramsey, M A, D V.M

Assistant Professor: Margaret W Sloss, M.S., D.V.M.

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree of Doctor of Veterinary Medicine, see page 150

The Department of Veterinary Pathology offers a systematic study of the causes of disease and the manner in which these causes bring about alterations in the anatomical structure and chemical and physiological activities of animal cells, tissues, organs, and systems of organs The application of these studies makes diagnosis more accurate and forms a foundation for the control of livestock diseases.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in veterinary pathology, and minor work to students taking major work in other departments.

The research facilities of the Veterinary Research Institute are available to qualified and approved students.

Prerequisite to major graduate work is the completion of an undergraduate curriculum leading to the degree of Doctor of Veterinary Medicine.

Minor work is recommended in bacteriology, veterinary hygiene, chemistry, zoology, entomology, physics, botany, or genetics.

Description of Courses

Courses Primarily for Undergraduate Students

254, 255. General Pathology. F.W.
254. (3-0 0) Cr. 3; 255. (2 0 6) Cr. 4
254. *Prerequisite:* Vet.Anat. 103, 113.
255. *Prerequisite:* 254, Vet.Anat. 103, 113; Vet. Hyg 224, Vet. Phys. 164.
Causes and effects of disease applying to the body as a whole.

256. Special Pathology. (5 0 6) Cr. 7. S.
Prerequisite: 255.
Etiology, pathogenesis, lesions, and termination of disease in organs or systems of organs and in specific infectious diseases.

257, 258. Veterinary Parasitology. W.S.
257. (3-0-2) Cr. 4; 258. (3-0-3) Cr. 4.
Prerequisite: 255.
Parasites and parasitic diseases of animals and the principles of their control.

450. Applied Avian Pathology. (3-0 0) Cr. 3. F.
Prerequisite: 256, 258, Vet.Hyg. 224, 225.
Problems of disease and resistance encountered in poultry.

455. Post Mortem and Clinical Pathology. (0 0 9) Cr. 3. S.
Prerequisite: 256, 258.
Post mortem and laboratory technics applied to diagnosis of veterinary hospital and field cases.

Courses for Graduate Students

604. Seminar. Cr. 1. F.W.S.
Mr. Benbrook

651, 652. General Pathology. F.W.
651. (3-0-0) Cr. 3; 652. (2-0-6) Cr. 4.
Prerequisite: (651) Vet Anat. 103, 113; (652) Vet.Hyg. 225, Vet.Phys. 266.
Fundamentals of disease with emphasis on disease in animals. Mr. Benbrook

653. Special Pathology. (5 0-6) Cr. 7. S
Prerequisite: 652. Mr. Ramsey
General pathologic fundamentals applying to organs or systems of organs and to specific infectious diseases of animals

656. Advanced Veterinary Pathology. (0-1-3 to 12) Cr. 2 to 5. F.W.S.
Prerequisite: 256 or 652 Messrs. Benbrook, Biester, Schwarte, Miss Sloss
Introduction to research in animal disease.

657, 658. Veterinary Parasitology. W.S.
657. (3-0 2) Cr. 4; 658. (3-0-3) Cr. 4.
Prerequisite: 652. Mr. Benbrook
Problems of parasitism in relation to animals.

659. Advanced Veterinary Parasitology. (0-1-3 to 12) Cr. 2 to 5. F.W.S.
Prerequisite: 256, 258 or 658. Messrs. Benbrook, Biester
Introduction to research in animal parasitology.

690. Research.
A. Veterinary Pathology. Messrs. Benbrook, Biester, Schwarte
B. Veterinary Parasitology Messrs. Benbrook, Biester

Veterinary Physiology and Pharmacology

HENRY DALE BERGMAN, D.V.M., Head of Department

Professors: Earl Albon Hewitt, D.V.M., Ph.D.; L. Meyer Jones, D.V.M., Ph.D.

Assistant Professor: Loyal Cobb Payne, D.V.M., M.S.

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree of Doctor of Veterinary Medicine, see page 150.

Before acquiring a proper concept of disease it is necessary to understand the normal functions of the body structures. In the courses in physiology the students make a detailed study of the normal functions and activities of the cells, tissues, organs, and systems constituting the animal body.

Pharmacology in its broad sense is the science that investigates drugs, and for convenience of study is often subdivided into pharmacognosy, pharmacy, pharmacodynamics, and toxicology. Each of these is given proper consideration in the courses in pharmacology, with special emphasis on drugs and therapeutic practices important in veterinary medicine.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in veterinary physiology, and minor work to students taking major work in other departments.

The research facilities of the Veterinary Research Institute are available to approved and qualified students

Students expecting to do major work should have fundamental knowledge of physiology, zoology, anatomy, histology, and chemistry. The exact requirements will depend upon the field of work the student expects to pursue.

Open to graduate students for minor only: 366; for major or minor, 604, 661, 662, 663, 667, 669, 690

Description of Courses

Courses Primarily for Undergraduate Students

164. Comparative Mammalian Physiology. (4-1-3) Cr. 6 S.
Prerequisite: Vet.Anat. 102, 112.
Physiology of the nervous system, special senses, muscular system and circulating fluids of the body.

265, 266. Comparative Mammalian Physiology. F.W.
265. (3-1 6) Cr. 6; 266. (4 1-3) Cr. 6.
Prerequisite: 164.
Physiology of the organs of circulation, respiration, digestion, urinary system, nutrition, animal heat, endocrine and reproduction.

267 General Pharmacology. (3 0 0) Cr. 3. S.
Prerequisite: 266
Pharmaceutical principles and processes; metrology, prescription writing; general properties and classification of drugs; therapeutic methods.

364. Physiology of Domestic Animals. (3-0 0) Cr. 3. F.
Prerequisite: Vet Anat. 217.
For agricultural students. Blood, lymph; circulatory and respiratory systems, organs of digestion and absorption.

366. Physiology of Domestic Fowls. (3 0 0) Cr. 3. W.
Prerequisite: 364 or equivalent.
For poultry husbandry, poultry industry, animal husbandry, and dairy husbandry students. Systematic survey of physiological processes in fowls.

367, 368, 369. **Pharmacology and Therapeutics.** Yr.
367. (3-0 0) Cr. 3; 368. (2 0-3) Cr. 3; 369. (3-0-0) Cr. 3.
Prerequisite: 266, 267.
Drugs important in veterinary medical practice, including therapeutic indications, administration, posology and pharmacodynamics.

465. **Animal Nutrition.** (3 0 0) Cr. 3. W.
Prerequisite: 266.
A practical approach to animal nutrition and nutritional therapy for veterinary students.

Courses for Graduate Students

604. **Seminar.** Cr. 1. F.W.S
Prerequisite: Vet.Anat. 502. Mr. Hewitt

661. **Comparative Mammalian Physiology.** (3 0-0 or 3-1 3) Cr. 3 or 5. S.
Messrs. Bergman, Hewitt
Especially adapted for graduate students as minor work in fields of animal, dairy or poultry husbandry; in biological sciences, chemistry and home economics. Physiology of the nervous system, special senses, muscle and circulating fluids of the body.

662, 663 **Comparative Mammalian Physiology.**
662. (3-0-0 or 3-0-6) Cr. 3 or 5. F; 663. (3-0-0 or 3-1-3) Cr. 3 or 5. W.
Messrs. Bergman, Hewitt
Continuation of 661. Physiology of the organs of circulation, respiration, digestion, urinary system, animal heat, endocrinology and reproduction.

667 **Advanced Physiology.** (0 1 to 5-0) Cr. 1 to 5. F.W.S.
Prerequisite: 663. Mr. Hewitt
Methods of approach to the specific phase of physiological research in which the individual is interested.

669. **Physiology of the Endocrine System.** (3-0 0) Cr. 3. W.
Prerequisite: Vet.Anat. 610. Mr. Hewitt
Survey of the functions of the endocrine organs and their interrelationship.

690 **Research.**
Physiology. Mr. Hewitt

Veterinary Surgery

GEORGE R. FOWLER, D.V.M., Head of Department

Assistant Professors: Walter Harris Chivers, D.V.M.; Oliver W. Whitcomb, D.V.M.

Opportunities for Undergraduate Study

For undergraduate curriculum in veterinary medicine leading to the degree of Doctor of Veterinary Medicine, see page 150.

Opportunities for Graduate Study

The department offers major work for the degree of Master of Science in veterinary surgery, and minor work to students taking major work in other departments.

The research facilities of the Veterinary Research Institute are available to approved and qualified students.

Prerequisite to major graduate work is graduation from an approved college of veterinary medicine.

Description of Courses

Courses Primarily for Undergraduate Students

371. **Surgery.** (5-0-0) Cr. 5. F.
Prerequisite: First two years of veterinary curriculum.
Fundamental principles.

372, 373. **Surgery.** (5-0 0) Cr. 5 each. W.S.
Prerequisite: 371.
Surgical diseases of horses, cattle, sheep, and swine.

381, 382, 383. **Clinics.** (0 0 12) Required. Yr.
Concurrent with Vet.Med. and Vet.Obst. 381, 382, 383.

481, 482, 483. **Clinics.** (0-0-18) Total Cr. 3 each, including Med. and Obst. Yr.
Concurrent with Vet.Med. and Vet.Obst. 481, 482, 483.

Courses for Graduate Students

604. Seminar. Cr. 1. F.W.S. Mr. Fowler

671. Advanced General Surgery. (1 1-3 or 9) Cr. 3 or 5. F.W.S. Mr. Fowler
Prerequisite: 378.
Detailed principles of veterinary surgery and anesthesia.

672. Advanced Special Surgery. (1-1-3 or 9) Cr. 3 or 5. F.W.S. Mr. Fowler
Prerequisite: 378.
Technics of the various operations and manipulations in veterinary surgery.

690. Research. Mr. Fowler

Vocational Education

RAY JAMES BRYAN, Ph.D., Head of Department

Professors Lowell L. Carver, M.S.; Thomas August Hippaka, Ph.D.; William Henry Lancelot, D.Ed.; John Barnhart McClelland, Ph.D.; Vilas J. Morford, M.Sc.; *Barton Morgan, Ph.D.; James Abel Starrak, D.Ed.; Arthur Perry Twogood, M.S.; James Edwin Wert, Ph.D.

Associate Professors: Martelle Loreen Cushman, Ph.D.; John Wallace Litherland, Ph.D.; J. Neil Raudabaugh, M.S.; T. E. Sexauer, Ph.D.

Assistant Professors: Clarence Everett Bundy, M.S.; Charles Thomas Dean, M.S.; Glenn H. Holmes, M.A.; O. Steve Knudsen, M.A.; Frank E. Wellman, M.A.

Instructors. Hanson, Thompson, Wiener

Opportunities for Undergraduate Study

For undergraduate curricula in agricultural education and in industrial education leading to the degree of Bachelor of Science, see pages 95 and 105

Professional courses for teachers are offered at the Iowa State College by the Departments of Vocational Education, Home Economics Education, Psychology, and the Division of Science. These are designed especially to prepare teachers for the following fields: vocational and general agriculture, vocational and general home economics, industrial arts, trades and industry, the sciences, mathematics, and physical education.

Students majoring in the several fields of education meet the requirements for the Standard Secondary Certificate in Iowa and similar certificates in most other states.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in vocational education, and minor work to students taking major work in other departments. The following fields in which research is being carried on by the department are appropriate for research by graduate students: agricultural education, home economics education, industrial education, and rural education.

Prerequisite to major graduate work in vocational education is preparation substantially equivalent to the completion of one of the undergraduate curricula in education offered at the Iowa State College and adequate proof that the student ranks above average in scholastic ability and vocational competency. Students should not complete plans for enrollment in the Graduate College with a view of

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becoming candidates for the degree of Doctor of Philosophy in vocational education without the approval of the head of the department.

The modern language requirement for the degree of Master of Science may be waived upon recommendation of the head of the department.

Open to graduate students for minor only: V.Ed. 426, 466, 467.

Professional Courses in Other Departments

Home economics education. H.Ed. 405, 406, 407, 504, 508, 605, 606, 607, 608, 610, 612, 614. (For course descriptions see pages 254 and 255.)

Physical education (men). Phys.Ed. for Men 318, 411, 412, 413, 491, 492, 493, 494. (For course descriptions, see page 285.)

Physical education (women). Phys.Ed. for Women 326, 330, 336, 338, V.Ed. 590H. (For course descriptions, see pages 287 and 323.)

Psychology. Psych. 204, 315, 334, 414, 433, 434, 536, 538. (For course descriptions, see pages 294, 295 and 296.)

Science. Sci. 417, 486, 496. (For course descriptions, see page 300); Engl. 394. (For course description, see page 231); Math 497. (For course description, see page 269)

Teacher Certification

The Iowa Standard Secondary Certificate will be issued to a person who holds a diploma from an accredited Iowa college certifying the completion of a four-year course; who has taken a minimum of 30 credits (20 semester hours) in one academic field with 22½ credits (15 semester hours) in each of two additional fields or 45 credits (30 semester hours) in one subject matter field and 30 credits (20 semester hours) in one additional field; who has taken 3 credits in principles of American government and who has taken a minimum of 20 semester hours credit in professional education distributed as follows:

(a) Methods of teaching and evaluating pupil progress (6 semester hours) 9 credits.

(b) Supervised student teaching at least (5 semester hours) 7½ credits.

(c) Professional education required of all candidates for teacher's certification.

The advanced secondary certificate will be issued to a person who has met the above requirements for the standard secondary certificate and who is the holder of a standard master's degree.

Persons interested in types of certificates not described above, or who wish to know what courses meet the specific requirements of any certificate, should communicate with the head of the Department of Vocational Education or write to the executive secretary of the State Board of Education Examiners, Des Moines, Iowa.

Teacher Placement

A Teacher Placement Office is maintained for those who are interested in educational positions. The services of this office are available to anyone who has been registered as a resident student of the Iowa State College. These services are extended gratuitously to both candidate and employer, except for an annual registration fee of $3 to cover, in part, the cost of postage and the preparing of credentials. Requests for information should be addressed to the Teacher Placement Office, 220 Curtiss Hall, The Iowa State College, Ames, Iowa.

Description of Courses

Courses in General Vocational Education

Courses Primarily for Undergraduate Students

304. **Principles of Education.** (0-3-0) Cr. 3. F.W.S.
Prerequisite: Quality point average 2.1.
Place of education in democracy; American public school system; modern objectives of education; legal and other qualifications of successful teachers.

305. **Methods of Teaching.** (0-3-0) Cr. 3. F.W.S.
Prerequisite: 304 and quality point average 2.1.
Methods of realizing such teaching objectives as interests, ideals, understandings and abilities with special emphasis on problem, project, and unit teaching.

417. **Supervised Teaching in the Sciences.** (Science 417) See Science.

426. **Principles of Secondary Education.** (0 3 0) Cr. 3. F.W.S.
Prerequisite: 305 or equivalent.
Problems of teacher relationships; pupil management and guidance; the curriculum; extracurricular activities; trends in secondary education.

434. **Supervised Practice in Guidance.** (0-0-9) Cr. 3. F.W.S.
Prerequisite: Permission of instructor.
Supervised participation in a public school guidance program.

490. **Special Problems.** Cr. 1 to 5. F.W.S.
Prerequisite: Senior college classification, quality point average of 2.5 or more for preceding two quarters.
A. Agricultural Education.
B. Vocational and Educational Guidance.
C. Curriculum Construction.
D. Principles of Education.
E. Methods of Teaching.

Courses for Advanced Undergraduate and Graduate Students

533. **Counseling High School Students.** (0-3 0) Cr. 3 S.
Prerequisite: 15 credits in education. Messrs. Bryan, Wellman
Basic principles and techniques of counseling in vocational, educational, and personal guidance.

534. **Administration of the Guidance Program.** (0-3 0) Cr. 3. W
Prerequisite: 15 credits in education. Messrs. Bryan, Wellman
Principles and practices in aiding students to make educational and vocational ad justments; occupational studies; testing and records; group guidance and follow-up.

535. **Evaluation of Educational Outcomes.** (0 2 or 3 0) Cr. 2 or 3. S
Prerequisite: 15 credits in education. Mr. Wert
Methods of evaluating educational outcomes; types of tests and their construction; use and interpretation of educational measures in teaching.

536. **Adult Education.** (0-1 or 2 3) Cr. 2 or 3. F
Prerequisite: 15 credits in education or permission of the head of the department
Messrs Bundy, McClelland, Sexauer
Survey of current trends and present activities in adult education. Special problems and practices in organizing adult education programs. Observation and evaluation of the community program of adult education

550. **Audio-Visual Methods in Education.** (0-2-3) Cr. 3 W.S
Prerequisite: 305 or equivalent. Messrs. Kooser, Litherland
Sources, selection, preparation, and use of audio-visual instruction materials. Review of scientific studies.

551. **Occupational Information.** (0 3-0) Cr. 3. F.
Prerequisite: 15 credits in psychology and education. Messrs. Bryan, Wellman
Growth and development of important occupations; statistics and trends. For teacher, counselor, and guide of adolescent pupils

552, 553. **Educational Statistics.** (0 3 or 4 0) Cr. 3 or 4 each. F.W
Prerequisite: 15 credits in education. Mr. Wert
Statistical concepts and procedures for teachers, school administrators, and research workers.

561. **Methods of College Teaching.** (0 2 or 3-0) Cr. 2 or 3. F.
Prerequisite: Permission of instructor Messrs. Sexauer, Starrak
Basic principles and procedures. abilities essential to effective teaching

584. **History of Education.** (0 3-0) Cr. 3 S
Prerequisite: 15 credits in education. Mr. Morgan
Historical foundations of education; modern movements in European countries.

590. **Special Topics.** Cr. 1 to 5. F.W.S.
Prerequisite: 15 credits in education.
A. Agricultural Education. Messrs. Bundy, McClelland, Sexauer
B. Adult Education. Messrs. Bundy, McClelland, Sexauer
C. Rural Secondary Education. Messrs. Bryan, Bundy, Cushman, Starrak, Wert
D. Vocational and Educational Guidance. Messrs. Bryan, Wellman
E. Administration of Rural and Vocational Education. Messrs. Bryan, Cushman, Morgan
F. Supervision of Rural and Vocational Education. Messrs. Bryan, Bundy, Morgan, Sexauer
G. Techniques of Research in Education. Mr. Wert
H. Administration and Supervision of Physical Education. Miss Guiot
I. Radio Education. Mr. Griffith
J. Conservation Education. Mr. Starrak
K. Audio-Visual Education. Mr. Litherland

593. **Workshop.** Cr. 1 to 5. SS.
Prerequisite: 15 credits in education.
A. Agricultural Education. Messrs Bundy, McClelland, Sexauer
B. Adult Education. Messrs. Bundy, McClelland, Sexauer
C. Rural Secondary Education. Messrs. Bundy, Cushman, Starrak
D. Vocational and Educational Guidance. Messrs. Bryan, Wellman
E. Administration and Supervision of Rural and Vocational Education. Messrs. Cushman, Morgan, Sexauer

Courses for Graduate Students

602. **Current Educational Movements.** (0-2 or 3-0) Cr. 2 or 3. W. Mr. Starrak
Survey of major movements and trends in modern education.

615. **Seminar.** (0-1 to 3-0) Cr. 1 to 3. F.W.S. Messrs. Cushman, Morgan, Starrak, Wert

624. **Research Methods in Education.** (0-2 or 3-0) Cr. 2 or 3. F. Mr. Wert
Adaptation of research techniques to problems in education. Primarily for students preparing to write theses.

690. **Research.** Messrs. Bryan, Bundy, Cushman, Lancelot, Litherland, McClelland, Morgan, Sexauer, Starrak, Wert

Courses in Agricultural Education

Courses Primarily for Undergraduate Students

110. **Freshman Problems.** (0-1-0) Required. S.
How to study, personal development, reading habits. Required of freshmen majoring in department.

211. **Observation and Survey of Agricultural Education.** (0-0-3) Cr. 1. F.
Visitation of high school departments of agriculture; observation and discussion of day school, young farmer and adult farmer programs.

321. **Methods in Agricultural Education.** (0-2-3) Cr. 3. F.W.
Prerequisite: 305 or equivalent.
Objectives, curricula, and methods in vocational education in agriculture.

424. **Young Farmer and Adult Education in Agriculture.** (0-2-3) Cr. 3. F.W.
Prerequisite: 304 or equivalent.
Part-time and evening classes in vocational education in agriculture for young farmers and adults. Departments are visited for the purpose of evaluating programs and results.

425. **Supervised Teaching in Agriculture.** Cr. 3 to 11. F.W.S.
Prerequisite: 321 or equivalent.
Three to nine weeks of full-time supervised teaching in public schools. To be scheduled with "as arranged" courses and special sections.

466. **Administration and Organization of Extension Education.** (0-3-0) Cr. 3. F.
Prerequisite: Permission of instructor.
History and philosophy of extension education in agriculture and home economics; plans of organization; extension programs; relationships with other agencies; selection and training of extension personnel.

467. **Methods of Extension Education.** (0-3-0) Cr. 3. W.
Prerequisite: Permission of instructor.
Principles and procedures of instruction and evaluation in extension education.

490A. **Special Problems in Agricultural Education.** F.W.S.
For description of course, see courses in General Vocational Education, page 322.

Courses for Advanced Undergraduate and Graduate Students

515. Teaching Farm Mechanics. (A.E. 515) (0 2 3) Cr. 3. F.W.S.
Prerequisite: Senior or graduate classification. Mr. Morford
Objectives and methods; equipment and management of shop; organization of shop programs. Students will plan and present demonstration of methods of teaching mechanical skills.

537. Methods of Teaching Adults. (0 1 or 2 3) Cr. 2 or 3 SS.
Prerequisite. Either 426, 466, 467, or permission of the head of the department.
Messrs Bundy, McClelland, Sexauer
Principles and practices; conducting forums; leading group discussions, using visual aids and teaching short unit courses. Observation of programs and methods.

538. Young Farmer Education in Agriculture. (0-1 or 2-3) Cr. 2 or 3. S.
Prerequisite: 424 or equivalent. Mr. McClelland
Organization, teaching materials, and techniques of conducting part-time classes in agriculture for out of school farm youth. Schools will be visited to evaluate programs and results.

590 Special Topics in Agricultural Education. F.W.S.
For description of course, see courses in General Vocational Edueation, page 323.

593A. Workshop in Agricultural Education. SS.
For description of course, see courses in General Vocational Education, page 323

Courses for Graduate Students

604. The Community School Program of Agricultural Education. SS.
(0-4 or 6-0) Cr. 2 or 3. Mr. McClelland
Organization of vocational agriculture in the community school; curricula supervised farming programs, student activities, and evaluation of results.

690. Research. F.W.S.
Messrs Bundy, McClelland

Courses in Home Economics Education

For description of courses, see Home Economics Education, page 254

Courses in Rural Education

Courses for Advanced Undergraduate and Graduate Students

541 Reorganization of Rural School Districts. (0 2 to 4 0) Cr 2 to 4 W
Prerequisite 15 credits of education or permission of instructor Mr. Cushman
Principles and procedures in reorganizing satisfactory units of attendance and administration in country and village areas, technique for making county-wide surveys, legislative and financial problems of reorganization

542 Administration of Small High Schools. (0 2 or 3 0) Cr. 2 or 3 F
Prerequisite 426 or equivalent. Mr. Cushman
Organization and administration of curriculum, extracurricular activities, teaching staff, pupil personnel, program of studies, and daily schedule

544 Administration of Village and Consolidated Schools. (0-2 or 3 0) Cr. 2 or 3. S
Prerequisite: 15 credits in education. Mr. Cushman
General administration of smaller school systems located in rural communities; organization of school systems, management of buildings and grounds, transportation, community relations.

545 Supervision of Rural Elementary Education.
(0-4 to 8-0) Cr. 2 to 4. SS.
Prerequisite 426 or equivalent Messrs. Bryan, Morgan
Principles and general techniques of supervision; supervision of arithmetic, science, health, and physical education.

547. Supervision of Rural Secondary Education. (0-6-0) Cr. 3. SS.
Prerequisite 426 or equivalent. Mr Bundy
Supervision of instructional program in smaller secondary schools.

590 Special Topics in Rural Education. F.W S.
For description of course, see courses in General Vocational Education, page 323

593 Workshops in Rural Education.
For description of course, see courses in General Vocational Education, page 323.

Courses for Graduate Students

644. Financial Administration of Rural Education. (0-4 to 8-0) Cr. 2 to 4. SS.
Mr. Cushman
Fiscal administration of local school systems; state and federal aid; units of administration and attendance.

676. **Supervision of Rural Elementary School Subjects.** (0-4 to 6-0) Cr. 2 or 3. SS.
Messrs. Bryan, Morgan
Courses of study and methods of instruction in reading, language, spelling, writing and social studies.

690. **Research.** F.W.S.
Messrs. Cushman, Lancelot, Morgan, Starrak, Wert

Courses in Industrial Education

Courses Primarily for Undergraduate Students

104. **Ornamental Metalwork.** (0-1-6) Cr. 3. W.
Use of metal in construction of useful projects; peening, twisting, forming, bending, riveting, spinning and etching.

105. **Woodfinishing.** (0-1-5) Cr. 3. F.
Finishing materials and techniques used in application; filling, staining, varnishing, lacquering, novelty finishes and furniture refinishing.

106. **Woodwork I.** (0-1-6) Cr. 3. F.
Care and use of hand tools; basic tool operations and their application to pattern making and woodworking.

107. **Plastics and Crafts.** (0-0-6) Cr. 2. W.S.
Plastic materials and their application to industrial arts shopwork; principles and techniques of crafts suitable for industrial arts craft classes.

150. **Introduction to the Teaching of Industrial Arts.** (0-3-0) Cr. 3. S.
Objectives, methods, and projects furnishing foundation for teaching industrial arts.

154. **Drawing for Teachers of Agriculture.** (0-0-6) Cr. 2. F.W.
Basic techniques and skills in drawing and their application to the problems of agricultural teachers.

205. **Woodwork II.** (0-1-6) Cr. 3.
Prerequisite: 105, 106.
Basic principles and practices involved in the use of power machines and their application to cabinet making.

250. **Industrial Arts Design.** (0-3-0) Cr. 3. W
Application of fundamental principles of design in planning of shop projects. Field trips to industries, museums, etc.

251. **Practical Electricity I.** (0-1-6) Cr. 3 W.
Fundamental principles of electricity with application through the construction of useful teaching aids.

252. **Practical Electricity II.** (0-1 6) Cr. 3. F.S.
Prerequisite: 251.
Fundamentals in motor and generator construction and repair.

254. **Bench Metalwork.** (0-1-6) Cr. 3. F.
Principles and practices of bench metalwork; layout, sawing, chiseling, filing, polishing, drilling, threading, construction of useful projects.

255. **Sheet Metalwork.** (0-1-6) Cr. 3. S.
Principles and practices involved in the use of sheet metal tools, equipment and materials, forming and fabrication, layout techniques.

258. **Woodwork III.** (0-1-6) Cr.3. S
Prerequisite: 105, 205.
Designing and constructing useful projects employing advanced hand and machine operations and techniques.

309. **Shop Planning and Organization.** (0-3 0) Cr. 3. S
Planning of school shops; selection and location of equipment; estimate of cost. Trips to secondary schools.

317. **Social Significance of Industrial Education.** (0-3-0) Cr. 3. W.
Social influences bearing on industrial education and effects of this form of education on society.

350. **School Shop Safety Education.** (0-2-0) Cr. 2. F.S.
Prerequisite: Senior college classification.
Analysis of accidents and accident prevention in the school shop, methods of initiating an effective safety program.

354. **Teaching Secondary Drawing.** (0-1-6) Cr. 3 W.S
Prerequisite: Six credits of drawing.
Organization of subject matter, methods, teaching aids, and evaluation, as applied to the teaching of drawing in high schools.

357. **Elementary Radio Construction and Service.** (0-1-6) Cr. 3. F.W.
Prerequisite: Permission of instructor.
Radio construction, service and repair as applied to the secondary school industrial arts program.

415. **Methods of Teaching Industrial Arts.** (0-3-0) Cr. 3. F.
Prerequisite: 150.
Methods common to industrial arts teaching, objectives, relationships, and techniques; visitation of high school departments of industrial arts.

416. **Supervised Student Teaching in Industrial Arts.** Cr. 3 to 12. F.W.S.
Prerequisite: 415.
Observation, evaluation of instruction, lesson planning, and classroom teaching in public schools.

454. **History of Industrial Education.** (0-3-0) Cr. 3. F.W.
Prerequisite: Senior college classification.
Historical background of development of industrial education essential to an understanding and appreciation of present day trends.

456. **The General Shop.** (0-1-6) Cr. 3. W.S.
Prerequisite: Senior college classification.
Shop organization and procedure; selection of units, projects and teaching aids; designing and developing of suitable problems.

490. **Special Problems in Industrial Education.** Cr. 1 to 5. F.W.S.
Prerequisite: Senior college classification, quality point average of 2.5 or more for two preceding quarters.

Courses for Advanced Undergraduate and Graduate Students

510. **Technique of Teaching Trades.** (0-6-0) Cr. 3. SS.
Prerequisite: Permission of instructor. Mr. Twogood
Teaching processes, methods of presentation and testing, lesson planning, organization of instruction.

514. **Foundation of Industrial Education.** (0-3-0) Cr. 3. W.
Alt. SS. Offered 1953
Prerequisite: Permission of instructor. Messrs. Baird, Twogood
Development of movement; Smith-Hughes Act, state plans, and laws relating to industrial education.

515. **Teaching Industrial Education.** (0-3-0) Cr. 3. W. Alt. SS. Offered 1952
Prerequisite: 415 or equivalent. Mr. Hippaka
Curricula, observation, demonstrations, class organization, shop management and control. Trips to schools and industries.

518. **Problems in Industrial Education.** (0-6-0) Cr. 3. Alt. SS. Offered 1952
Prerequisite: Permission of instructor. Messrs. Baird, Twogood
Administration and supervision of industrial education programs in public schools.

519. **Trade Analysis.** (0-6-0) Cr. 3. Alt. SS. Offered 1952
Prerequisite: Permission of instructor. Messrs. Baird, Twogood
Basic types of analysis. Preparation of instruction sheet for teaching trade subjects.

524. **Industrial Conference Methods.** (0-6-0) Cr. 3. Alt. SS. Offered 1953
Prerequisite: Industrial or industrial teaching experience. Messrs. Baird, Twogood
Use of conference method in instruction. Study and practice of conference procedure, devices, and technique.

525. **Co-ordination in Part-time Industrial Education.** (0-6-0) Cr. 3. SS.
Prerequisite: Permission of instructor. Mr. Twogood
Demands upon supervisors, principals, teachers, and co-ordinators working in part-time industrial schools for employed minors.

551. **Industrial Occupations.** (0 3-0) Cr 3 S. Alt. SS. Offered 1953
Prerequisite: 15 credits in education or psychology. Mr. Hippaka
Changing conditions in industry, employment opportunities and preparation of workers for industry; problems of employees and employers; industry-community relationships. Field trips to schools and industries.

555. **Administration and Supervision of Industrial Education.** (0-3-0) Cr. 3. F.
Alt. SS. Not offered 1953
Prerequisite: 415. Messrs. Carver, Hippaka
Administration, supervision, curriculum development, selection of staff, and public relations. Trips to schools and industries.

590. **Special Topics in Industrial Education.** Cr. 1 to 5. F.W.S.
Prerequisite: 15 credits in education.
A. Industrial Arts. Messrs. Carver, Hippaka
B. Trades and Industry. Messrs Baird, Twogood

Courses for Graduate Students

652. **Evaluation in Industrial Education.** (0-2 or 3 0) Cr. 2 or 3. W.
Alt. SS. Offered 1953
Mr. Hippaka
Scoring of industrial education units. Evaluating programs in industrial education.

656. **Analysis and Organization of Instruction.** (0-3-0) Cr. 3. S
Alt. SS. Not offered 1958
Mr. Hippaka
Planning and use of such teaching methods and devices as job sheets, instruction sheets, demonstrations, prospect method, manuals, exhibits, recitation and class discussion.

657. **Curriculum Building in Industrial Education.** (0 3-0) Cr. 3. F.
Organization of indutrial education curricula. Alt SS. Offered 1958
Mr. Hippaka

690. **Research.** Messrs. Carver, Twogood

Zoology and Entomology

HALBERT MARION HARRIS, Ph.D., Head of Department

Professors: Elery Ronald Becker, D.Sc.; Tom Albert Brindley, Ph.D.; Paul Lester Errington, Ph.D.; Harold Gunderson, Ph.D.; George Oscar Hendrickson, Ph.D.; Harry Hazelton Knight, Ph.D.; John H. Lilly, Ph.D.; Robert M. Melampy, Ph.D.; Floyd B. Paddock, M.S.; Oscar Wallace Park, Ph.D.; Charles Howard Richardson, Ph.D.; Oscar E. Tauber, Ph.D.; Walter Housley Wellhouse, Ph.D.

Associate Professors: Kenneth Dixon Carlander, Ph.D.; Howard Laverne Hamilton, Ph.D.; Edward L. Kozicky, Ph.D.

Assistant Professors: Philip Frederic Bonhag, Ph.D.; Ellis A. Hicks, Ph.D.; James A. Slater, Ph.D.; *George Sprugel, Jr., M.S.; Robert L. Terry, Ph.D.; Martin John Ulmer, Ph.D.

Instructors: Bliese, Froeschner, Fronk, Goleman, Harding, Laffoon, Moorman, Raun, Thompson, Walstrom

Opportunities for Undergraduate Study

For undergraduate curriculum in science, major in zoology, leading to the degree of Bachelor of Science, see page 145.

The department offers courses which are fundamental to specialization in medicine and dentistry, agriculture, forestry, veterinary science, and home economics, as well as in the various branches of biology. The curriculum in science, with major in zoology, is flexible and adaptable to the needs of the individual student.

Special training is offered in parasitology, protozoology, physiology, embryology, wildlife conservation, fishery management, general and applied entomology, medical entomology, and apiculture. Graduates may find employment as biologists, aides, technicians and technologists, conservationists, entomologists, teachers and research and extension specialists with federal, state and municipal agencies or industrial and private organizations.

Undergraduate majors in this department usually have included the following basic courses in their programs: 104, 105, or 101, 102, 103, or 106, 107; 224, 234, 274, 351, 424, 512. As supporting work, undergraduate majors have found the following courses desirable: Gen. 300; Bot. 101, 205, 424; Chem. 101, 102, 103, 334, 335; Psych. 204; Soc. 234; Math. 101, 102, 103, or 101, 112, 113; Geol. 200; Phys. 211, 212, 213; Bact. 304A; Ec. 261, 262. These lists of courses are not to be regarded as statements of fixed requirements or as complete

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outlines of the work necessary for the major. They are given here solely for the convenience of students or counsellors who wish to estimate the amount of basic, non-specialized study which may be needed.

Opportunities for Graduate Study

The department offers major work for the degrees of Master of Science and Doctor of Philosophy in the fields of morphology, ecology, taxonomy, embryology, physiology (comparative and insect), protozoology, parasitology, entomology (general taxonomic, economic, and medical), apiculture, wildlife management, and fishery management; and minor work to students taking major work in other departments.

Prerequisite to major graduate work is the completion of at least two years of zoological courses, for part of which credit in other biological sciences may be substituted. Comprehensive courses in general zoology and general chemistry (and in most cases also organic chemistry) are required of all students. Specific course requirements for the advanced degrees depend upon previous training and experience and upon major field of specialization.

Open to graduate students for minor only: 424, 457, 458, 472, 474.

Description of Courses

Courses Primarily for Undergraduate Students

*101, 102, 103. General Zoology. (2-0 6) Cr. 4 each. Yr.
Observations on form and activities of representative animals and discussions of fundamental principles. For majors in zoology, and those preparing for study of medicine.

*104, 105. General Biology. (2-0-3) Cr. 3 each. 104 F.W.S.; 105 W.S.
105. *Prerequisite:* 104.
(104) Introduction to the fundamental principles of biology with brief study of some representative organisms.
(105) Continuation of 104, with brief review of the animal kingdom.

*106, 107. Animal Biology. (2-0-3) Cr. 3 each. W.S.
107. *Prerequisite:* 106.
(106) Principles as shown in structure, functions, and habits of invertebrates, with emphasis on their economic relations with man.
(107) Continuation of 106 but dealing with vertebrates.

109. Animal Biology. (3-0-3) Cr. 4. F.S.
For Agricultural Education, Animal Husbandry and Farm Operation students. Basic facts and principles with applications to farm life.

155. Physiology for Home Economics Students. (3-0-6) Cr. 5. F.W.S.
Functions of human organ systems. For non-zoology majors who have not had college biology.

203. Human Biology. (0-3-0) Cr. 3. S.
Prerequisite: 103, 105, or 107.
Outline of evolution from sub-human to human, evidences from fossil record, anatomy and embryonic development of the body.

224 Comparative Anatomy. (2 0-6) Cr. 4. F.W.S
Prerequisite: 103, 105, or 107.
Study of selected vertebrate types with emphasis on those not examined in general courses.

226. Anatomy. (2-1-3) Cr. 4. W.
Prerequisite: 105 and P.E. 213
Vertebrate anatomy with emphasis on regions especially concerned in sports and physical rehabilitation. Essentials of kinesiology. For physical education students.

234. Vertebrate Embryology. (2 0 6) Cr. 4. W.
Prerequisite: 224.
Germ cell formation, fertilization, cleavage, tissue and organ development, foetal membranes and their uses. For science majors.

*A student may receive a maximum of 12 credits toward graduation for these general biology courses. Only one of the following will count toward graduation: Zool. 101, 104, 106; the same rule applies to 105 and 107. If he has taken 106 and 107, or 104 and 105, he will receive only 2 credits for 102 if taken subsequently and may take 108 for 4 credits.

274. **Elementary Entomology.** (2-0-6) Cr. 4. F.S.
Structure, life history, habits and recognition of common insects, with interesting facts about their relations with man.

325. **Mammalian Anatomy.** (2-0-6) Cr 4. W.
Prerequisite: 224.
Advanced study and dissection of cat, rabbit or other mammals. Designed for zoology majors and those preparing for study of medicine.

334. **Embryology.** (2-0-3) Cr. 3. F.
Prerequisite: 109.
Elements of vertebrate embryology including summary of principles of mammalian development. For animal husbandry students.

340. **Bird Study.** (1-0-3) Cr. 2. S.
Recognition in field and laboratory; habits, songs, values of birds.

351. **Human Physiology.** (2-0-6) Cr. 4. W.
Prerequisite: 103 or 105, and Chem. 102 or 106.
Essentials of human physiology for majors in zoology and related sciences.

374. **Farm Insects.** (2-0-6) Cr. 4. W.S.
Life history, recognition and control of principal insects and other arthropods attacking plants and animals.

375. **Insects Affecting Horticulture.** (3-0-6) Cr. 5. S.
Prerequisite: 274 or 374.
Identification, life history, and methods of control of more important orchard, garden and greenhouse insect pests.

377. **Forest Insects.** (2 0-3) Cr. 3. F.
Prerequisite: 107, For. 102.
Life histories and habits of insects injurious to forests, forest products and ornamentals.

380. **The Honey Bee.** (2-0-0) Cr. 2. F.
The honeybee, its social organization and its usefulness in pollination and honey production.

384. **Elementary Apiculture.** (0-2-0 or 3) Cr. 2 or 3. S.
General principles necessary to successful operation of colonies of bees.

424. **Histological Technique.** (1-0-6) Cr. 3. F.W.S.
Prerequisite: 103, 105 or 107.
Methods of fixing, sectioning, mounting, and staining tissues for microscopic study. Preparation of whole mounts.

457. **Physiology of Muscular Activity.** (2-0-6) Cr. 4. S.
Prerequisite: 226 and 351.
Explanations of muscle contraction; factors involved in muscle fatigue.

458. **Physiology of Reproduction.** (2-0-3) Cr. 3 F.W.S.
Prerequisite: 155.
Physiology aspects of intra-uterine life; maternal fetal relationship; reproductive hormones.

472. **Insect Morphology.** (0-1-6) Cr. 3. F.
Prerequisite: 274.
Gross morphology of typical insects, with special attention to structures emphasized in systematic and applied entomology.

474. **Field Entomology.** (0-4-12) Cr. 4. SS.
Prerequisite: 103, 105, or 107.
Survey of insect world, including classification, life histories, literature, and ecology. Emphasis on field observations, making and naming personal collection of insects.

490. **Special Problems.** Cr. 2 to 5. F.W.S.
Prerequisite: 15 credits in zoology and permission of instructor.
Individual problems for beginners in research.

Courses for Advanced Undergraduate and Graduate Students

500. **Seminar.** Cr. 1. F.W.S.
Prerequisite: 15 credits in zoology. Mr. Harris
Reports of original investigations, current literature, special features.

501. **Animal Ecology.** (3-0-3) Cr. 4. F.
Prerequisite: 103 or 107, 274. Mr. Knight
Relation of animals to environment; geographical distribution, climatic factors, ecological succession. Field and experimental work.

503. **Evolution of Animals.** (2-0-0) Cr. 2. S.
Prerequisite: 103, 105, or 107. Mr. Wellhouse
Problems and factors in organic evolution, variation, origin, and distribution of life.

505. **Limnology.** (2-0-3) Cr. 3. F.
Prerequisite: 103, 105, or 107; and Chem. 102. Mr. Carlander
Lakes and streams as an environment for fish; fauna and ecological relationships.

511. **Parasitology I.** (2-0-6) Cr. 4. F.
Prerequisite: 108, 105, or 107, and 351. Mr. Becker
Survey of the free-living and parasitic protozoa; identification, life cycles, and host-parasite relationships of forms important to agriculture, wildlife and man.

512. **Parasitology II.** (2-0-6) Cr. 4. W.
Prerequisite: 108, 105, or 107, and 351. Mr. Becker
Survey of the cestodes, trematodes, and nematodes parasitic in wildlife, laboratory animals, and man; study of selected vectors; identification, life histories, and host-parasite relationships emphasized.

517. **Invertebrate Zoology.** (2-0 6) Cr. 4. Alt. S. Offered 1953
Prerequisite: 108, 105, or 107. Mr. Becker
Advanced study of invertebrates stressing classification, morphology, life history, and economic relationships.

526. **Physical Growth of Children.** (3-0 0) Cr. 3. W.
Prerequisite: 458 or equivalent. Mr. Tauber
For Child Development majors. Changes in body structure from infancy through childhood.

527. **Normal Histology.** (2-0-6) Cr. 4. W.
Prerequisite: 284. Mr. Hamilton
Microscopic structure of the tissues and organs of vertebrates in relation to function.

528. **Cytology** (2-0-3) Cr. 3. Alt. S. Offered 1953
Prerequisite: 424. Mr. Hamilton
Structure and function of cells in development, inheritance, histogenesis, and pathological conditions.

534. **Embryology.** (2-0-6) Cr. 4. W.
Prerequisite: 224. Mr. Hamilton
Principles and processes of development in vertebrates.

538. **Experimental Embryology.** (2-0-6) Cr. 4. S.
Prerequisite: 284 or 534. Mr. Hamilton
Physiology of germ-cells; parthenogenesis; marking and grafting experiments on living embryos, tissue culture techniques.

541. **Game Birds.** (2-0-3) Cr. 3. F.
Prerequisite: 107, 340, and Bot. 206 or equivalent. Mr. Hendrickson
Recognition, life histories, habits, predators and economic relationships of game birds.

542. **Game Mammals.** (2-0-3) Cr. 3. W.
Prerequisite: 103, 105 or 107, and Bot. 206 or equivalent. Mr. Hendrickson
Recognition, life histories, habits, predators and economic importance of game and fur producing mammals.

544. **Techniques in Wildlife Management.** (2 0 6) Cr. 4. S.
Prerequisite: 541, 542. Mr. Hendrickson
Specimen preparation; food habits analysis; fur trapping and grading; wildlife surveys; data collection; report preparation; cover mapping; job analysis.

545. **Wildlife Administration.** (2-0 3) Cr. 3. F.
Prerequisite: 544. Mr. Hendrickson
Organization, financing, personnel and supervision of federal, state, and private wildlife programs.

550. **Comparative Physiology.** (3 0 0) Cr. 3. Alt. S. Offered 1953
Prerequisite: 224 and 351. Mr. Tauber
Functions in the various phyla, with interpretations in terms of morphology, ecology, and evolution.

551, 552, 553. **Advanced Physiology.**
Prerequisite: 224, 351, organic chemistry Mr. Melampy
551. Nervous system and sense organs. (2-0-3) Cr. 3. F.
552. Blood, circulation and respiration. (2-0 3) Cr. 3 W.
553. Digestion, metabolism and excretion; endocrine system. (3-0-3) Cr. 4. S

555. **General Physiology.** (2-0-6) Cr. 4. F.
Prerequisite: Organic Chemistry. Mr. Tauber
Principles of animal physiology from study of isolated cells and cell groups.

561. **Fishes.** (2-0-3) Cr. 3. W.
Prerequisite: 103, 105 or 107. Mr. Carlander
Common fishes of North America; recognition, life histories and habits.

562. **Fishery Management.** (3-0-3) Cr. 4. S.
Prerequisite: 505, 561. Mr. Carlander
Management policies and practices relating to maintenance and improvement of fishery resources.

563. **Fish Propagation and Pond Management.** (2 0-3) Cr. 3. Alt. W. Not offered 1953
Prerequisite: 562. Mr. Carlander
Fish propagation methods, hatchery management, control of fish diseases; problems concerned with management of farm ponds.

567. **Amphibians and Reptiles.** (2 0 3) Cr. 4. Alt. S Not offered 1953
Prerequisite: 224. Mr. Carlander
Classification, distribution, ecology, and habits of amphibians and reptiles of the world. Laboratory emphasis upon local species.

574. **Medical and Sanitary Entomology.** (2-0-6) Cr. 4. S.
Prerequisite: 108, 105 or 107 and 274. Mr. Knight
Identification, life histories, and control of insects and near relatives attacking man, particularly those forms serving as vectors of diseases.

575. **Insect Toxicology.** (2-0-6) Cr. 4. S.
Prerequisite: 472 and 555. Mr. Richardson
History and literature; poisons and their nature; action of poisons on insects; evaluation of insecticides, attractants, and repellents.

576, 577. **Systematic Entomology.** (0 0-9) Cr. 3 each. W.S.
576. *Prerequisite:* 472. Mr. Knight
577. *Prerequisite:* 576.
(576) Classification, nomenclature, and taxonomic practices. (577) Emphasis on making collection, special groups.

590. **Special Topics.** Cr. 2 to 5. F.W.S.
Prerequisite: 15 credits in zoology and permission of instructor.
A. Zoology. Messrs. Becker, Hamilton, Ulmer
B. Physiology. Messrs. Melampy, Tauber
C. Entomology. Messrs. Brindley, Harris, Knight, Lilly, Richardson, Slater, Wellhouse
D. Apiculture. Mr. Park
E. Wildlife. Messrs. Errington, Hendrickson, Hicks, Kozicky
F. Fishery Management. Mr. Carlander

Courses for Graduate Students

601. **Literature.** (3-0-0) Cr. 3. W.
Prerequisite: 103 or 107, 274, 374. Mr. Knight
Review of literature and classical authors of zoology and entomology; nomenclators and rules of zoological nomenclature.

612. **Parasitology III.** (3-0-0) Cr. 3. Alt S. Not offered 1953
Prerequisite: 511, 512. Mr. Becker
Special phases in host-parasite relationships of parasitic protozoa, worms and arthropods.

645. **Wildlife Conservation.** (3 0-0) Cr. 3. W.
Prerequisite: 545. Mr. Hendrickson
Theories and principles of wildlife conservation, management practices, and special topics.

655. **Insect Physiology.** (2-0-6) Cr. 4. W.
Prerequisite: 472, 555. Mr. Tauber
Life processes of insects.

663. **Fishery Resources of North America.** (3-0 0) Cr. 3. Alt. W. Offered 1953
Prerequisite: 562. Mr. Carlander
Survey of fishery resources; analysis of problems concerned with commercial and sport fisheries and their management.

672. **Advanced Insect Morphology.** (3-0-0) Cr. 3. F.
Prerequisite: 472. Mr. Wellhouse
Principles of structure and development of insects.

674. **Applied Entomology.** (2-0-6) Cr. 4. W.
Prerequisite: 103, 105, or 107; 274, 374. Mr. Lilly
Identification, ecology, and geography of insect pests. Principles and methods of chemical and natural control.

675. **Advanced Insect Toxicology.** (2-0-6) Cr. 4. Alt. W. Not offered 1953
Prerequisite: 575, 655, 674. Mr. Richardson
Developments and trends in research on insecticides, attractants, and repellents.

690. **Research.**
A. Zoology. Messrs. Becker, Hamilton, Ulmer
B Physiology, Messrs. Melampy, Tauber
C. Entomology. Messrs. Brindley, Harris, Knight, Lilly, Richardson, Slater, Wellhouse
D. Apiculture. Mr. Park
E Wildlife. Messrs. Errington, Hendrickson, Kozicky
F Fishery Management. Mr. Carlander

Short Courses

R. M. VIFQUAIN, M.S., Chairman

Iowa State College's short courses are open to everyone interested in the information they offer. They are conducted for two purposes: To enable men and women in the same field to meet for a discussion of mutual problems, and to give them an opportunity to discuss and study their problems with college specialists in the light of most research findings. Since each course is limited in scope and time, they all deal directly and practically with the field indicated.

A few weeks before the opening of each course, detailed information regarding rooms, registration, location of meeting, study program and speakers may be obtained.

The short course bulletin illustrating and giving a descriptive write-up of each course is printed October 1 each year. A copy may be had upon request by writing to the chairman.

Experiment Stations and Research Institutes

Agricultural Experiment Station

Administrative Staff

CHARLES EDWIN FRILEY, B.S., A.M., LL.D., Sc.D., President

FLOYD ANDRE, Ph.D., Director

GEORGE M BROWNING, Ph.D., Associate Director

PEARL SWANSON, Ph.D., Assistant Director

Resident Collaborators[1]

DORIS ALCOCK, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.

K. D. ARBUTHNOT, Bureau of Entomology and Plant Quarantine, U.S.D.A.

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R. V. BAUMAN, Bureau of Agricultural Economics, U.S.D.A.

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WAYNE BLACKBURN, Soil Conservation Service, U S.D.A.

HOWARD L. BOSSART, Bureau of Agricultural Economics, U.S.D.A.

WILLIAM G BRADLEY, Bureau of Entomology and Plant Quarantine, U.S.D.A.

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[1]A collaborator is a person working on an active Experiment Station project whose salary is paid directly by some agency other than the Iowa State College, and who does not have academic rank.

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D I. WINGER, Soil Conservation Service, U.S D.A

Regular staff are listed under The Faculty. See page 7.

Since the opening of the Iowa State College in 1869 experimental work has been carried forward in agriculture. This work has been devoted to finding

facts useful to the people of Iowa—particularly the farm people. Since the passage of the Hatch Act of 1887 by the Federal Congress, the Agricultural Experiment Station has been an integral part of the Iowa State College. The research work in Agriculture and Home Economics has been expanded to meet the needs of the farm people of Iowa. This has been possible through the annual appropriations made available by the Hatch Act of 1887, the Adams Act of 1906, the Purnell Act of 1925, the Bankhead-Jones Act of 1935, and the Research and Marketing Act of 1946, through appropriations made by the State Legislature and through gifts and grants by private donors.

Findings made through research are the basis of the teaching program in agriculture and the extension program in agriculture and home economics. The need to carry on basic as well as applied research that will contribute to the solution of complex problems has been kept in mind at all times.

In addition to the main station in Ames, experimental work is carried on at several outlying farms and in the fields of dozens of farmer cooperators out in the state. These experimental areas have been selected so as to represent the specific soil types of the state where special problems can be studied on a local basis. The program at the main station is and always has been the backbone of the whole research effort.

In addition to the research being carried on by the departments of Agricultural Engineering, Agronomy, Animal Husbandry, Dairy Industry, Agricultural Economics and Rural Sociology, Forestry, Genetics, Horticulture, Poultry Husbandry, Technical Journalism, and Vocational Education, the Agricultural Experiment Station also supports research in Animal Pathology, Agricultural Bacteriology, Botany and Plant Pathology, Agricultural Chemistry, Home Economics, Agricultural Statistics, Economic Entomology and Wildlife.

The results of these studies are made available to the people of Iowa and interested groups elsewhere directly by the research, teaching and extension staffs of the College and by means of Station publications. These publications include Station bulletins, other technical and scientific publications, popular series bulletions (issued jointly by the Agricultural Experiment Station and the Extension Service in Agriculture and Home Economics) and the Iowa Farm Science (published jointly on a monthly basis by the Agricultural Experiment Station and the Extension Service in Agriculture and Home Economics).

Engineering Experiment Station

CHARLES EDWIN FRILEY, B.S., A.M., LL.D., Sc.D., President

J. F. DOWNIE SMITH, Sc.D., Director

GEORGE R. TOWN, D.Engr., Associate Director and Professor of Electrical Engineering

The Iowa Engineering Experiment Station at Iowa State College was organized in 1904 for the purpose of providing organized research of the character needed to foster and develop the industries of the State.

Since its organization the Station has completed research projects intended to encourage the development of the raw materials and natural resources of the State, to increase the utilization of agricultural products and by-products, to aid

in establishment of additional industry within the State, and to solve engineering problems arising in municipal, county, and state administrations. The latter problems have included research in purification of industrial wastes, sanitation, and highway and roadway construction.

Special emphasis has been placed on research to develop increased industrial use of agricultural products and by-products or waste materials, to foster an industrial base for the agriculture of the State, and to utilize in new products those waste materials which are of little practical value in present agricultural production.

The Station is prepared to undertake basic and applied research in the fields of architecture, aeronautics, ceramics, highways, materials, and in civil, electrical, industrial, mechanical, agricultural, and chemical engineering. Studies in valuation and depreciation methods may also be undertaken.

The results of the studies are published in research bulletins, engineering reports, and papers, or otherwise made readily available to those interested.

Industrial Science Research Institute

CHARLES EDWIN FRILEY, B.S., A.M., LL.D., Sc.D., President

HAROLD V. GASKILL, Ph.D., Director

The Division of Science, through its staff in cooperation with other research organizations of the College, sponsors a comprehensive program of research in the sciences. The primary purpose of the program is to aid in the solution of the agricultural and industrial problems of Iowa through the application to these problems of the principles, the techniques, and the improved processes developed in the Departments of Bacteriology, Botany, Chemistry, Economics and Sociology, Mathematics, Physics, Psychology, Statistics, and Zoology and Entomology and in Food Technology. The research work is coordinated with that of the Agricultural Experiment Station, the Engineering Experiment Station, the Veterinary Research Institute, and the Institute for Atomic Research.

Institute for Atomic Research

CHARLES EDWIN FRILEY, B.S., A.M., LL.D., Sc.D., President

FRANK H. SPEDDING, Ph.D., LL.D., D.Sc., Director

HARLEY A. WILHELM, Ph.D., Associate Director

ELLIS I. FULMER, Ph.D., D.Sc., Assistant to the Director

ADOLF F. VOIGT, Ph.D., Assistant to the Director

During World War II Iowa State College played a leading part in the basic research which resulted in the large scale release of atomic energy.

In order that the program of the College in this field might be carried forward in peace-time, the Iowa State College Institute for Atomic Research was authorized by the Iowa State Board of Education on November 1, 1945. Its purposes are:

To build up and maintain a strong group of scientists working in the fundamental phases of physics and chemistry as they apply to nuclear processes and

to develop the aspects of physics, chemistry, metallurgy, and engineering which are naturally associated with these fields.

To have available on the campus a group of experts in these newer developments so that other members of the faculty can consult them concerning the application of these new tools to their own problems.

To encourage cooperation and coordination in this type of research work on the campus on a voluntary basis. Particular emphasis will be placed on borderline fields between the several sciences where expert advice is needed from several different fields.

To serve as a central agency for contacts with the government in the obtaining of special materials such as isotopes, radioactive tracers, special counting instruments, and similar materials, and to serve as a clearing house for the special information which the government has at its disposal as a result of war research.

To act for the College as the cooperating agency with the Argonne National Laboratory and the cooperating mid-western universities.

To carry out research in the nuclear and associated fields for the government when authorized by contract with the College.

To carry out research whereby graduate students may obtain the specialized knowledge and skills which they will need in order to do independent research in these fields. It is obvious that a great many men will have to be trained to use these tools in the interest of national welfare and security since there is an acute shortage of such personnel. The formal course work is given and degrees awarded through the several departments and divisions. The research training is given in the Institute.

In general, the objective of the Institute is to develop the peace-time uses of atomic energy and the by-products from it.

Ames Laboratory of the Atomic Energy Commission

FRANK H. SPEDDING, Ph.D., LL.D., D.Sc., Director

HARLEY A. WILHELM, Ph.D., Associate Director

ELLIS I. FULMER, Ph.D., D.Sc., Assistant to the Director

ADOLPH F. VOIGT, Ph.D., Assistant to the Director

WOODROW E. DREESZEN, M.A., Administrative Aide to the Director

ALEXANDER E. EDWARDS, B.S., Administrative Aide to the Director

RAY W. FISHER, B.S., Administrative Aide to the Director

CLARENCE H. RAH, Administrative Aide to the Director

Due to the outstanding record of achievement made by the Iowa State College Project during the war years, the Atomic Energy Commission decided to continue this program of research in the nuclear and associated fields at Iowa State College in the post war period. Accordingly, it established on the campus one of its major research centers known as the Ames Laboratory of the Atomic Energy Commission. This Laboratory specializes in the basic and pioneering types of researches that are necessary to the development of the fields associated with atomic energy.

The College has leased to the Atomic Energy Commission, an area on the campus on which the Commission has completed the Metallurgy Building and is erecting the Research Building. The work carried out in these buildings will be classified due to the requirements of the Atomic Energy Act. However, since the major part of the work done here is of a fundamental and basic nature, much of the material is soon released for publication in the scientific journals.

Veterinary Research Institute

CHARLES EDWIN FRILEY, B.S., A.M., LL.D., Sc.D., President

H. D. BERGMAN, D.V.M., Director

HARRY E. BIESTER, V.M.D., Associate Director

The Veterinary Research Institute, located one mile south of the campus on Beech Avenue, has excellent laboratory and housing facilities for research work in animal diseases. The object of the department is to investigate those diseases of food-producing animals whose cause or control is not well understood, thereby developing methods by which they may be controlled or eradicated. Close cooperation is maintained with the veterinary diagnostic laboratory and other departments.

Staff members of the institute participate in the advanced undergraduate teaching program by presenting material from fields in which they are conducting research. The results of research by the institute staff are made available for general instructional purposes. The Veterinary Research Institute staff also actively supports the graduate program by providing research direction and guidance as well as facilities for graduate study.

See Veterinary Hygiene 590 and 690.

See Veterinary Pathology 656 and 690.

Iowa Veterinary Diagnostic Laboratory

PAUL C. BENNETT, M.S., D.V.M., Supervisor

For many years, laboratory diagnostic service to the livestock industry of Iowa has been provided by the Division of Veterinary Medicine, Iowa State College, through its Department of Veterinary Pathology. Recently, through a joint arrangement with the Division of Animal Industry, Iowa Department of Agriculture, the diagnostic laboratory has been reorganized and established within the Veterinary Division as the Iowa Veterinary Diagnostic Laboratory. Plans are in preparation for a new building to provide for the expanded laboratory facilities and personnel necessary to serve adequately the Iowa livestock industry in disease control problems, involving all species of animals, including poultry.

The laboratory receives from all parts of Iowa thousands of specimens for examination. While the laboratory is maintained primarily to provide technical service to veterinarians and others within the state in the diagnosis of animal diseases, much of the specimen material received for diagnosis is also valuable for use in the instruction of veterinary students.

Statistical Laboratory

CHARLES EDWIN FRILEY, B.S., A.M., LL.D., Sc.D., President

T. A. BANCROFT, Ph.D., Director

The Statistical Laboratory was organized in 1933 for the purposes of promoting and fostering the use of statistical methods in the researches of the College and of conducting research in statistical theory and methodology. It was the first statistical center of its kind in the United States, organized on an interdivisional basis. Although there is hardly a field of investigation in which statistical methods cannot be used with advantage, rarely in colleges and universities have the persons trained in those methods been brought together into a single organized group. In order to facilitate the development and use of better methods, the Statistical Laboratory cooperates closely with and offers its services to research workers in all departments of the College and the several experiment stations and research institutes.

Veterinary Clinics

M. J. JOHNSON, Director

Veterinary Clinics include medical, obstetrical, and surgical clinics for large and small animals. The hospital building accommodates 77 large animals and 94 small animals. Stalls and kennels are constructed of steel and concrete, thus affording the best of sanitary conditions. Thirty-three of the stalls are designed for cattle. Thirty commodius box stalls for horses serve also as quarters for sheep and swine. Isolation quarters are provided for the care of animals suffering from communicable diseases. Clinic rooms and operating rooms are well equipped with stocks, mats, operating tables and other modern equipment. Dispensaries and instrument rooms are conveniently located to serve the clinic and operating rooms and are adequately provided with sterilizers, surgical and diagnostic instruments. Complete Roentgen ray equipment is available for radiography, fluoroscopy and therapy in large and small animals.

Two automobiles are maintained so that students can be taken to the farms to assist in the care of patients that cannot be brought to the hospital. This enables the student to obtain experience in the diagnosis and treatment of various diseases under actual field conditions. The rich livestock producing area near the College provides an abundance of clinical material of a variety usually found in the veterinarian's practice.

Junior and senior students are required to spend several hours each day in the clinics. The junior students assist the seniors in the supervised care of sick and injured animals. Scholastic credit in clinical practice, including the junior year, is awarded in each of three quarters of the senior year. The combined judgment of all staff members of three departments actively contributing to the clinics determines the final quarter marks of each student.

Clinical conferences are held in the senior year involving detailed discussions of selected clinical cases by student groups, the regular clinic staff, and staff members from the basic departments of anatomy, hygiene, physiology, and pathology. At these conferences the special technics used in diagnostic tests, in administering biologics, collecting blood samples, and other clinical practices are discussed and demonstrated and then practiced by the senior students.

See Departments of Medicine, Obstetrics, and Surgery for description of the clinical courses.

Extension Services

Extension Service in Agriculture and Home Economics

Administrative Staff

CHARLES EDWIN FRILEY, B S., A M , LL.D , Sc.D., President

FLOYD ANDRE, Ph D , Director

MAURICE WILLIAM SOULTS, B S , Assistant Director

PAUL CLIFFORD TAFF, B.S.A., LL D., Assistant Director, Rural Youth Leader

LOUISE MARIE ROSENFELD, B.S , Assistant Director for Home Economics

HENRY L. EICHLING, B.S.A., Assistant to the Director

The Iowa State College serves the people of the state through its coordinated programs of resident teaching, research and extension. The College is authorized to undertake and maintain a system of agricultural extension work by action of the state legislature in 1906. In 1914 the United States Congress passed the Smith-Lever Act which provided for Cooperative Extension Work as a part of the land grant college system. The Smith-Lever Act provided for cooperation between the United States Department of Agriculture, the land grant college, the county government and local organized groups of farm people and others in each state interested in agricultural extension education. The Smith-Lever Act has been supplemented by the Capper-Ketcham Act of 1928, the Bankhead-Jones Act of 1935, the Bankhead-Flanagan Act of 1945 and the Research and Marketing Act of 1946, all of which provide resources for the development of the Extension Service in the state.

Financial support for extension work in agriculture and home economics comes from state, federal, and county appropriations supplemented by voluntary contributions from local groups. Under Iowa statute a cooperative relationship exists between the Extension Service and the county farm bureaus (as farm aid associations which sponsor educational activities in the county). However, it should be emphasized that the Extension Service works with many different organizations, agencies and institutions and offers educational services to all the people of Iowa, especially the farm people.

It is the responsibility of the Extension Service in Agriculture and Home Economics to carry the results and benefits of research to all people of the state. It is the purpose of the Service to reach every farm family and also urban dwellers interested in agriculture and home economics. It is recognized that all citizens of the state are directly or indirectly concerned with agriculture and are to be offered the benefits of the Service.

The program in extension is broad in scope, including balanced farm production, conservation of natural resources, efficient marketing and distribution of farm raised products, improved standard of living on farms and in farm homes, youth development and education, community improvement, better relations between rural and urban people and greater participation by rural people in public affairs.

The activities of members of the extension staff embrace the fields of animal husbandry, dairy husbandry, poultry husbandry, dairy industry, veterinary medicine, agricultural engineering, agronomy, botany and plant pathology, forestry, horticulture, zoology and entomology, economics and sociology, music and recreation, applied arts, child development, home management, foods and nutrition, and textiles and clothing. Assistance is given to both adult and youth groups. Nearly 50,000 local volunteer leaders assist in their home counties and communities in carrying on the various extension activities.

The Extension Service in Agriculture and Home Economics works with farm organizations, cooperative associations, breed associations, farm management associations, dairy herd improvement associations and many other similar organizations. It also works with the Production and Marketing Administration, Soil Conservation Service, Farmers Home Administration, Rural Electrification Administration of the Federal Department of Agriculture, farm credit and vocational agriculture groups, soil conservation district personnel and various other official agencies. It cooperates with the public schools, churches and various other civic and community organizations of the state.

Extension information on agriculture and home economics subjects is disseminated through meetings, conferences, training schools, demonstrations, visual aids, by radio, through the local and daily press, farm journals, bulletins, pamphlets, circulars and other media.

Preparation for Extension Service in Agriculture and Home Economics

Attractive opportunities are open each year in extension education in agriculture and home economics to properly qualified graduates of the divisions.

The preparation required for successful performance in this field varies considerably. For field workers, a rather broad education in technical agriculture and home economics and in related sciences, plus systematic education, is highly desirable. For subject matter specialists, the training required is more concentrated in one of the various areas of agriculture or home economics instruction. For both groups the special training suggested above should be supplemented by appropriate courses in psychology, speech, sociology, technical journalism and vocational education.

Students who desire to prepare for employment in extension education should, not later than their sophomore year, seek the advice of their counselors and the personnel officers of the Division of Agriculture, Home Economics and of the Extension Service. Junior and senior students may gain experience by working as assistants to the County Extension Director or County Extension Home Economist during the summer.

Recommended courses are V. Ed. 466 and 467. Suggested electives: Psych. 204, 334; Sp. 311, 312; Soc. 464, 486, 487; T.Jl. 225, 475; V. Ed. 305, 537, 550.

Staff Services

In addition, by arrangement or state statute, services are available in the following fields: Dairy testing, soil testing, seed laboratory, vaccination schools, soil conservation, music, drama, library, human health, visual aids and Extension studies.

The service prepares and produces many radio programs and publishes and distributes large amounts of printed materials.

For more complete information about Extension programs send requests to Floyd Andre, Director, Morrill Hall, Iowa State College, Ames, Iowa.

Engineering Extension Service

CHARLES EDWIN FRILEY, B.S., A.M., LL.D., Sc.D., President

J. F. DOWNIE SMITH, Sc.D., Director

G. ROSS HENNINGER, B.S., Assistant Director.

The Engineering Extension Service of Iowa State College is maintained to serve the people of the state along engineering and industrial lines.

EXTENSION CLASSES. Extension classes in engineering and industrial subjects are conducted wherever enough persons are interested in one subject to make such classes possible. Courses in foremanship are offered in extension classes to groups of foremen and others in executive positions in industry.

The following courses are offered in extension classes for graduate or undergraduate credit to those having the required preparation for admission:

I. Ed. 510. Technique of Teaching Trades.....3 credits

I. Ed. 514. Foundations of Industrial Education.....3 credits

I. Ed. 518. Problems of Industrial Education.....3 credits

I. Ed. 519. Trade Analysis.....3 credits

I. Ed. 524. Industrial Conference Methods.....3 credits

I. Ed. 525. Co-ordination in Part-time Industrial Education.....3 credits

Courses I. Ed. 510, 514, 518, 519 are offered by correspondence for undergraduate credit only.

For description of these courses, see Department of Vocational Education. Courses in Industrial Education, page 325.

INDUSTRIAL SHORT COURSES. In co-operation with educational, trade and industrial organizations, Engineering Extension conducts short courses of instruction at the College and at various points throughout the state. These courses vary in length from one day to a week, depending upon the nature of the work. The instruction in these courses is intensely practical and consists of lectures, demonstrations, and laboratory work.

TECHNICAL INFORMATION. Technical information is made available to the various interests of Iowa through the collection of information, investigations, conferences, lectures, exhibits, bulletins, and answers to inquiries.

Full particulars concerning any of the work mentioned will be given on application to the Engineering Extension Service, The Iowa State College, Ames, Iowa.

Summary of Degrees Conferred

1950-1951

	Total Including Year 1950-1951	Year 1950-1951
BACCALAUREATE DEGREES 1872-1951		
PRESENT CURRICULA		
Aeronautical Engineering, 1942-1951	188	11
Agricultural Economics and Rural Sociology, 1922-1951	401	20
Agricultural Education, 1913-1951	711	79
Agricultural Engineering, 1910-1951	520	42
Agricultural Journalism, 1922-1951	126	6
Agronomy, 1905-1951	839	53
Animal Husbandry, 1904-1951	2,327	93
Architectural Engineering, 1916-1951	509	29
Architecture, 1945-1951	10	1
Ceramic Engineering, 1910-1951	164	15
Chemical Engineering, 1910-1951	1,218	51
Chemical Technology, 1929-1951	304	16
Civil Engineering, 1872-1951	1,970	106
Dairy Industry, 1904-1951	610	18
Dairy Industry and Chemistry, 1932-1951	21	
Dairy Industry and Economics, 1937-1951	37	
Electrical Engineering, 1892-1951	2,422	102
Farm Operation, 1944-1951	142	58
Forestry, 1896-1951	862	84
General Engineering, 1927-1951	1,131	92
Home Economics, 1907-1951	7,398	312
Horticulture, 1904-1951	272	10
Industrial Education, 1922-1951	278	55
Landscape Architecture, 1921-1951	258	18
Mechanical Engineering, 1872-1951	2,242	136
Mining Engineering, 1907-1951	96	1
Poultry Husbandry, 1911-1951	107	6
Science, 1875-1951	3,157	264
Veterinary Medicine, 1880-1951	1,633	67
DISCONTINUED CURRICULA		
Agricultural Course, leading to degree of B.S., 1870-1880	102	
Agricultural Course, leading to degree of B.S.A., 1883-1888 and 1894-1904	86	
Agricultural and Manual Training, leading to degree of B.S., 1922-1933	25	
Agriculture and Science, 1929-1940	54	
Agronomy Course, leading to degree of B.Ag., 1891-1898	50	
General Agriculture, 1937-1939	18	
General Science, 1932-1939	113	
General Science Course for Ladies, 1872-1880 and 1904	48	
General and Domestic Science Course, leading to degree of B.L., 1887-1899	93	
General and Domestic Science Course, leading to degree of B.Ph., 1899-1900	21	
General and Domestic Science Course, leading to degree of B.S., 1901-1908	78	
Home Economics and Agriculture, leading to degree of B.S., 1917-1930	37	
Ornamented Ceramics, leading to degree of B.S., 1932-1937	5	
Science and Agricultural Course, leading to degree of B.S., 1889-1900 and 1909-1914	48	
Baccalaureate Degrees Conferred, 1872-1951	30,731	1,745
HIGHER DEGREES 1872-1951		
Doctor of Philosophy	1,211	108
Master of Landscape Architecture	4	
Master of Science	4,544	294
(Discontinued 1906—Master of Philosophy, 7; Master of Domestic Economy, 2)	9	
Professional Degrees:		
In Engineering	344	2
Master of Agriculture	58	
Master of Forestry	12	
Master of Landscape Architecture	1	
Honorary Degrees:		
Doctor of Agriculture	6	1
Doctor of Engineering	13	1
Doctor of Laws	5	
Doctor of Science	34	
(Discontinued 1908—Master of Philosophy, 6; Master of Science, 9)	15	
Higher Degrees Conferred, 1872-1951	6,256	406
All Degrees Conferred, 1872-1951	36,987	2,151

Summary of Enrollment by Grades

1950 - 1951

For students whose status changed within the period from July 1, 1950 to June 30, 1951, the latest classification within the year is used as the basis for these enrollment statistics.

DIVISION	Graduate College Students			Undergraduate Collegiate Students																		Non-collegiate students			Graduate, collegiate, and non-collegiate students			Engineering extension (off campus)	Short courses	Grand total
				Seniors			Juniors			Sophomores			Freshmen			Specials			Total												
	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Total excluding duplicates	Total excluding duplicates	
Agriculture	595	373	786	575	271	644	480	91	492	535	87	553	513	16	523	410	51	456	2513	516	2668	48		48	3156	889	3502		13548	17050
Engineering	186	133	226	648	375	794	504	124	519	390	89	413	455	33	475	14	8	21	2011	629	2222		.		2197	762	2448	6701	2127	11276
Home Economics	89	170	233	324	171	387	289	58	305	391	37	404	415	11	418	46	58	98	1465	335	1612				1554	505	1845		3532	5377
Science	642	403	726	288	136	326	352	80	367	320	47	330	355	12	360	40	51	84	1355	326	1467	189	119	287	2186	848	2480		.	2480
Veterinary Medicine	13	9	14	65	1	65	68	3	68	62	1	62	56		56				251	5	251	....			264	14	265	.	253	518
Total	1525	1088	1985	1900	954	2216	1693	356	1751	1698	261	1762	1794	72	1832	510	168	659	7595	1811	8220	237	119	335	9357	3018	10540	6701	19460	36701
Duplicates (Agricultural Engineering)	35	23	39	50	28	62	32	4	33	23	6	23	12	1	13	8	.	8	125	39	139	.			160	62	178	.	. .	178
Net Total	1490	1065	1946	1850	926	2154	1661	352	1718	1675	255	1739	1782	71	1819	502	168	651	7470	1772	8081	237	119	335	9197	2956	10362	6701	19460	36523

DIVISION OF AGRICULTURE	Graduate College Students			Undergraduate Collegiate Students																		Non-Collegiate Students			Graduate, Collegiate, and Non-Collegiate Students		
				Seniors			Juniors			Sophomores			Freshmen			Specials			Total								
	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates
Agriculture, Unassigned	1	...	1	.	.	.	.			2	.	2	1		1	14	15	29	17	15	32	...	....		18	15	33
Agricultural Economics	3	....	3	16	5	16	15	3	15	22	2	22	7		7	1	1	2	61	11	62	.	..		64	11	65
Agricultural Education	...	...		80	51	88	81	23	82	51	4	53	48	1	49	323	20	341	583	99	613	...	..		583	99	613
Industrial Education	33	56	74	49	38	58	31	9	33	28	2	28	16	1	16	24	13	35	148	63	170	...			181	119	244
Vocational Education	320	140	427	.	.	.	.			.						.		.	..		.	..			320	140	427
Agricultural Engineering	35	23	39	50	28	62	32	4	33	23	6	23	12	1	13	1	.	1	118	39	132				153	62	171
Rural Builders	...	...	.	.	.	.	.			.						7		7	7	..	7			.	7		7
Agricultural Journalism	14	7	17	10	4	13	11	2	11	7	4	9	15		15			..	43	10	48	.		.	57	17	65
Agronomy	82	62	96	54	25	58	48	14	50	50	7	51	27		27	5	1	5	184	47	191		..	..	266	109	287
Animal Husbandry	39	35	48	94	44	105	64	8	68	81	8	83	89	1	89	1	1	2	329	62	347	.		.	368	97	395
Dairy Husbandry	11	7	14	9	6	11	16	2	16	14	1	14	17	1	17	1		1	57	10	59				68	17	73
Dairy Industry	12	8	13	20	6	21	21	1	21	17		17	16		16	1		1	75	7	76			.	87	15	89
Dairy Plant Operations	.	....	....	...	.	.										30		30	30	.	30			...	30		30
Farm Operation	.	...	...	54	24	58	85	6	87	138	14	143	192	1	192	1		1	470	45	481				470	45	481
Forestry	9	3	9	99	26	108	45	16	45	59	30	63	45	6	50			...	248	78	266			..	257	81	275
Genetics	16	14	21	.	..	....			..	.	.	.	.				.	..	....	..			....	..	16	14	21
Herdsmen	...	...	..	.	.				...	.	.							.	..	..		48	.	48	48		48
Horticulture	10	11	12	16	6	18	7		7	22	3	22	7		7	1		1	53	9	55	.	...	..	63	20	67
Landscape Architecture	2	1	2	20	6	23	15	3	15	12	5	14	17	2	18				64	16	70	.	.	.	66	17	72
Poultry Husbandry	8	6	10	4	2	5	9		9	9	1	9	4	2	6				26	5	29	.	.	...	34	11	39
Total	595	373	786	575	271	644	480	91	492	535	87	525	513	16	523	410	51	456	2513	516	2668	48	....	48	3156	889	3502

DIVISION OF ENGINEERING	Graduate College Students			Undergraduate Collegiate Students																		Non-Collegiate Students			Graduate, Collegiate, and Non-Collegiate Students		
				Seniors			Juniors			Sophomores			Freshmen			Specials			Total								
	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates
Aeronautical Engineering	3	2	4	8	9	13	25	9	26	18	6	21							51	24	60	..	..	....	54	26	64
Agricultural Engineering	35	23	39	50	28	62	32	4	33	23	6	23	12	1	13	1		1	118	39	132	.	.	..	153	62	171
Rural Builders	..	..	..	..	..	..	..	..	..	..	..	.	.			7		7	7	..	7	..	..	..	7	..	7
Architectural Engineering	5	2	6	32	15	35	11	2	11	10	2	11					1	1	53	20	58	.	..	.	58	22	64
Architecture				23	6	24	64	10	64	45	13	48				1		1	133	29	137	.			133	29	137
Ceramic Engineering	1	1	1	19	5	20	16	3	16	12	3	12				.		.	47	11	48	.	..		48	12	49
Chemical and Mining Engineering																											
Chemical Engineering	50	27	54	56	45	73	32	8	33	22	4	22							110	57	128	.		.	160	84	182
Mining Engineering	1		1	2	2	3	1	1	1	3		3							6	3	7	.		.	7	3	8
Civil Engineering	25	22	35	108	85	140	73	30	76	54	15	58							235	130	274	....	...		260	152	309
Electrical Engineering	34	31	45	118	36	130	87	19	89	66	12	69				1		1	272	67	289	....	...	..	306	98	334
Engineering, Unassigned	1		1	.	..	..	1		1	12	4	15	443	32	462	3	7	9	459	43	487	....	...	...	460	43	488
General Engineering	4	5	6	89	50	112	54	7	57	47	6	50					..		190	63	219	.	.	....	194	68	225
Industrial Engineering	4	3	4	14	6	17	15	2	15	3	2	4							32	10	36	.	.	..	36	13	40
Mechanical Engineering	13	11	18	129	88	165	93	29	97	75	16	77		.		1		1	298	133	340		...	....	311	144	358
Theoretical and Applied Mechanics	10	6	12	....		....	...	....	..	.	.		....	.		.	..	...	...	.		...	....	...	10	6	12
Total	186	133	226	648	375	794	504	124	519	390	89	413	455	33	475	14	8	21	2011	629	2222	....	....	....	2197	762	2448

DIVISION OF HOME ECONOMICS	Graduate College Students			Undergraduate Collegiate Students																		Non-Collegiate Students			Graduate, Collegiate, and Non-Collegiate Students		
				Seniors			Juniors			Sophomores			Freshmen			Specials			Total								
	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates
Applied Art	1	7	7	37	16	44	31	9	35	42	4	43				7	2	8	117	31	130				118	38	137
Child Development	6	11	15	35	20	39	19	6	21	38	1	38							92	27	98				98	38	113
Foods and Nutrition																											
Dietetics				36	24	45	30	3	31	27		27					1	1	93	28	104				93	28	104
Experimental Cookery				14	6	15	9	2	10	10		10							33	8	35				33	8	35
Foods	10	8	16																						10	8	16
Nutrition	12	10	18	2	1	2	1	1	1							1		1	4	2	4				16	12	22
Related Science							1		1										1		1				1		1
Unassigned	11	13	23	1		1	6	1	6	7		7				2	1	3	16	2	17				27	15	40
General Home Economics				8	3	8	9	2	9	9		9							26	5	26				26	5	26
Home Economics																											
Major Related Science		1	1	3	1	3	1		1	1		1							5	1	5				5	2	6
Major Technical Journalism				11	3	11	9	2	10	12	2	14				1		1	33	7	36				33	7	36
Unassigned				5	6	8	6	1	7	85	5	85	415	11	418	28	33	58	539	56	576				539	56	576
Home Economics Education	19	77	89	116	50	134	109	15	111	95	15	99				5	15	19	325	95	363				344	172	452
Home Management	6	8	11	4	7	10	6	3	6	4	2	5							14	12	21				20	20	32
Household Equipment	5	2	6	18	5	20	12	2	13	15	2	17							45	9	50				50	11	56
Institution Management	10	11	17	9	7	11	18	6	20	20	4	21					3	3	47	20	55				57	31	72
Textiles and Clothing	9	22	30	25	22	36	22	5	23	26	2	28				2	3	4	75	32	91				84	54	121
Total	89	170	233	324	171	387	289	58	305	391	37	404	415	11	418	46	58	98	1465	335	1612				1554	505	1845

DIVISION OF SCIENCE	Graduate College Students			Undergraduate Collegiate Students																		Non-Collegiate Students			Graduate Collegiate, and Non-Collegiate Students		
				Seniors			Juniors			Sophomores			Freshmen			Specials			Total								
	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates	Academic year	Summer quarter	Total excluding duplicates
Chemical Technology				19	8	19	14	4	16	14	2	14	16		16				63	14	65				63	14	65
Music																						137	43	159	137	43	159
Science																											
Major Bacteriology	27	13	27		1	1	2		2										2	1	3				29	14	30
Major Botany	55	38	65	5	2	6	11	5	11										16	7	17				71	45	82
Major Chemistry	197	113	207	20	8	23	21	6	21										41	14	44				238	127	251
Major Economics	75	57	95	3	1	3	1	1	2								1	1	4	3	6				79	60	101
Major Food Technology	10	8	10	4	1	4													4	1	4				14	9	14
Major General Science				13	6	13	18	4	18										31	10	31				31	10	31
Major Genetics	1	1	1													1		1	1		1				2	1	2
Major Geology	8	2	8	18	17	20	10	6	11										28	23	31				36	25	39
Major History and Government	2	1	2	9	3	10	8	4	10							1		1	18	7	21				20	8	23
Major Industrial Economics	5	3	6	81	40	96	74	15	78							1		1	156	55	175				161	58	181
Major Mathematics	34	22	38	16	5	17	25	6	25							1	1	1	42	12	43				76	34	81
Major Physical Education for Men				14	7	17	9	2	10										23	9	27				23	9	27
Major Physics	75	34	87	17	12	20	25	7	25							1	1	1	43	20	46				118	54	133
Major Psychology	24	18	30	12	7	16	11	2	12							1		1	24	9	29	52	76	128	100	103	187
Major Sociology	21	17	23	9	3	9	16	1	16										25	4	25				46	21	48
Major Statistics	28	17	31	5	2	5	10	1	10										15	3	15				43	20	46
Major Technical Journalism				12	1	12	14	1	14										26	2	26				26	2	26
Major Zoology	76	59	92	25	7	26	23	4	24								1	1	48	12	50				124	71	143
Unassigned	4		4	6	5	9	60	11	62	306	45	316	339	12	344	34	47	76	745	120	807				749	120	811
Total	642	403	726	288	136	326	352	80	367	320	47	330	355	12	360	40	51	84	1355	326	1467	189	119	287	2186	848	2480
DIVISION OF VETERINARY MEDICINE																											
Veterinary Medicine	13	9	14	65	1	65	68	3	68	62	1	62	56		56				251	5	251				264	14	265
Total	13	9	14	65	1	65	68	3	68	62	1	62	56		56				251	5	251				264	14	265

Enrollment 1950-1951 Distributed by Sex and by Veterans and Non-Veterans (Includes graduate and undergraduate collegiate students and non-collegiate students)

Divisions	Veterans		Non-Veterans		Total		Grand Total
	Men	Women	Men	Women	Men	Women	
Agriculture	814	1	2186	501	3000	502	3502
Engineering	774	1	1667	6	2441	7	2448
Home Economics		26	2	1817	2	1843	1845
Science	546	10	1385	539	1931	549	2480
Veterinary Medicine	189		76		265		265
Total	2323	38	5316	2863	7639	2901	10540
Duplicates (Agricultural Engineering)	67		111		178		178
Net Total	2256	38	5205	2863	7461	2901	10362

Summer Quarter Students, 1950

Divisions	First term only	Second term only	Twelve weeks	Total	Summer and Academic Year	Students Attending Summer Only
Agriculture	305	56	528	889	543	346
Engineering	259	87	416	762	511	251
Home Economics	262	72	171	505	214	291
Science	249	91	508	848	554	294
Veterinary Medicine	11		3	14	13	1
Total	1086	306	1626	3018	1835	1183
Duplicates (Agricultural Engr.)	18	11	33	62	44	18
Net Total	1068	295	1593	2956	1791	1165

Short Courses

May 21, 1950 to June 30, 1951

DIVISION OF AGRICULTURE	Enrollment	
Agricultural Credit School for Bankers	68	
Artificial Breeding, State Conference	401	
Artificial Breeding	42	
Audio-Visual Teachers	33	
Beekeepers	46	
Cattle Feeders	4,200	
Commercial Florists	118	
Cooperative Youth Education	45	
County School Administrators	110	
Crop Improvement	400	
Dairy Industry Day	469	
Farm Electrification Training School for 4-H Leaders	83	
Farm Fuel Conservation	40	
Farm Managers, Iowa Association	79	
Farm Home Administration Supervisors	46	
Farm Operators	146	
Fertilizer Dealers	229	
Fertilizer Manufacturers	97	
Greenkeepers	56	
Guidance	76	
Hatchery Flock Inspection and Pullorum Testing School	150	
Horsemen	50	
Horticultural Groups	844	
Beekeepers	60	
Fruit Growers	30	
Garden Club	736	
Iowa Gladiolus Society	18	
4-H Boys	2,074	
Industrial Education Teachers	83	
Iowa Press Columnists	25	
Iowa Retail Farm Equipment	37	
Lamb Feeders	150	
Landscape Clinic	46	
Livestock Judging	149	
Motion Picture Projectionists	101	
Newspaper Women	34	
Nutrition School for Feed Dealers and Manufacturers	300	
Pest Control	50	
Power Use School (R.E.A.)	41	
Production and Marketing Administration	262	
Raw Products (Canners)	78	
Rose Growers	122	
Rural Pastors Institute	84	
Rural Young People Leaders	65	
Rural Youth Assembly	525	
Seed Analysts	85	
Soil Conservation District Commissioners	119	
Soil Management and Land Valuation	188	
Swine Producers Day	909	
Timber Operators	28	
Town and Community Planning	78	
Tractor School for 4-H Leaders	87	
Total		13,548

DIVISION OF ENGINEERING	
Better Concrete	64
City Engineers	52
County Engineers	118
Coal Mine Operators	27
Custodian School	407
Diesel Power Plant Conference	113
Drivers Education Conference	58
Electrical Association Conference	98
Fire Department Inspectors School	24
Fire School	440
Forced Warm Air	49
Industrial Accident Prevention Clinic	46
Midwest Gas School	303
Motor Vehicle Fleet Supervisors	51
School of Modern Heating	77
Surveyors	57

Teachers of Engineering Mechanics	80	
Traffic Engineering School	36	
Use of Isotopes in Industry	27	
Total		2,127

DIVISION OF HOME ECONOMICS

4-H Girls	2,985	
Homemakers Conference	194	
School Lunch for High School Cooks	103	
Vocational Home Economics Teachers	250	
Total		3,532

DIVISION OF VETERINARY MEDCINE

Bovine Mastitis	19	
Nutrition Conference for Veterinarians	234	
Total		253
Grand Total Enrollment for Short Courses		19,460

Engineering Extension

May 21, 1950 to June 30, 1951

Extension Classes:	Enrollment	
Rural Electric Safety and Job Training	916	
Fireman Training	3,169	
Industrial Supervision and Management	146	
Industrial Teacher Training	289	
Industrial Safety	180	
Total		4,700
Short Courses (On Campus)	1,880	
(Off Campus)	121	
Total		2,001
Grand Total Enrollment		6,701

Index

The Iowa State College of Agriculture and Mechanic Arts

Academic Curricula and Programs

Special announcements of the different branches of the work are supplied free of charge, on application. Address THE REGISTRAR, the Iowa State College, Ames, Iowa.

DIVISION OF AGRICULTURE

CURRICULA LEADING TO THE DEGREE OF BACHELOR OF SCIENCE

Agricultural Economics and Rural Sociology
Agricultural Education
Agricultural Engineering
Agricultural Journalism
Agronomy
Animal Husbandry
Dairy Husbandry
Dairy Industry
Dairy Industry with Major in Chemistry (Five-year)
Dairy Industry with Major in Economics
Farm Operation
Forestry
Forestry (Five-year) Majors in
- Conservation
- Forest Utilization
- Range Management
- Wildlife Management

Horticulture, Majors in
- Floriculture
- Nursery Management
- Pomology
- Vegetable Crops

Industrial Education
Landscape Architecture
Poultry Husbandry

NON-DEGREE AGRICULTURAL PROGRAMS

Dairy Plant Operation (Four quarters)
Farm Operation (Six quarters)

NON-COLLEGIATE PROGRAM

Herdsmen (Two quarters)

DIVISION OF ENGINEERING

CURRICULA LEADING TO THE DEGREE OF BACHELOR OF SCIENCE

Aeronautical Engineering
Agricultural Engineering
Architectural Engineering
Ceramic Engineering
Chemical Engineering
Civil Engineering
Electrical Engineering
General Engineering

Option in Industrial Engineering

Mechanical Engineering
Mining Engineering

CURRICULUM LEADING TO THE DEGREE OF BACHELOR OF ARCHITECTURE

Architecture (Five-year)

DIVISION OF HOME ECONOMICS

CURRICULA LEADING TO THE DEGREE OF BACHELOR OF SCIENCE

Applied Art
Child Development
Foods and Nutrition, Majors in
- Dietetics
- Experimental Cookery
- Nutrition in Public Health and Welfare
- Related Science

General Home Economics
Home Economics Journalism
Home Economics and Related Science
Home Economics Education
Home Management
Household Equipment
Institution Management
Textiles and Clothing

DIVISION OF SCIENCE

CURRICULA LEADING TO THE DEGREE OF BACHELOR OF SCIENCE

Agricultural Economics and Rural Sociology
Chemical Technology
Science with Majors in
- Bacteriology
- Botany
- Chemistry
- Climatology and Meteorology
- Economics and Sociology
- Food Technology
- Genetics
- General Science
- Geology
- History and Government
- Industrial Economics
- Industrial Psychology
- Mathematics
- Naval Science
- Physical Education for Men
- Physics
- Statistics
- Technical Journalism
- Zoology and Entomology

PREPARATION FOR HUMAN MEDICINE (Three or four years)

PREPARATION FOR VETERINARY MEDICINE (Two years)

DIVISION OF VETERINARY MEDICINE

CURRICULA LEADING TO THE DEGREE OF DOCTOR OF VETERINARY MEDICINE

Veterinary Medicine

The College

The Iowa State College of Agriculture and Mechanic Arts conducts work in five major fields:

AGRICULTURE

ENGINEERING

HOME ECONOMICS

SCIENCE

VETERINARY MEDICINE

The Graduate College conducts research and instruction in all these fields.

Four-year and five-year collegiate curricula are offered in the different divisions of the College. Non-degree programs are offered in agriculture and engineering. Summer sessions include graduate and collegiate work. Short courses are offered in the winter.

Extension courses are conducted at various points throughout the state.

Six special research institutes have been organized: the Agricultural and Engineering Experiment Stations, the Veterinary and Industrial Science Research Institutes, the Guatemala Tropical Research Center, and the Institute for Atomic Research.

Special announcements of the different branches of the work are supplied, free of charge, on application.

Address, THE REGISTRAR, THE IOWA STATE COLLEGE,

Ames, Iowa.